A NEW

TREATISE

ON THE

GLAUCOMA,

OR

CATARACT.

BY

SILVESTER Ô HALLORAN, *of* Limerick,
SURGEON.

Veniet tempus, quo, istâ quæ nunc latent, in lucem dies extrahet. SENECA.

Unius labor, multorum laborem allevat.

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M DCC L.

TO

Richard Mead, Esq;

OF THE

COLLEGE of PHYSICIANS,
London;

Fellow of the *Royal Society*,
&c.

LEARNED SIR,

IT is a Complaint made by the judicious *Heister*, that few People attend to the Study of the *Eye*, or it's Disorders, with the At-

A tention

tention which ſo delicate a Subject requires; tho' certainly the moſt entertaining for Speculation, and the moſt uſeful with reſpect to Practice. But various things have concurred to diſcredit this Study; the uncertain Method of treating thoſe Diſorders; the various Sentiments of Authors, on the Seat and Nature of a *Cataract;* their confus'd Differences between it and the *Glaucoma;* and the very few regular *Surgeons,* who have

have publickly profeſſed any Knowledge of it, have all together heaped ſuch a Load of Calumny on it, that it ſeemed dangerous for any one, mindful of his own *Character*, to make any Attempt, to reſcue it from the many Injuries it lay under. Yet have there of late Years appeared Perſons, who, more regardful of the Honour of *Medicine*, than of the private Inſinuations, and Slanders of ſome of the Profeſſors of it, have dared to ſhew,

the true Cauſes and Cures of the Diſorders of this beautiful and moſt uſeful Organ; amongſt whom, we muſt, with Honour, mention, a *Petit*, a *Briſſeau*, and a *Ranby*.

But tho' theſe generous Attempts, had cauſed the Diſeaſes of the Eye, to be more particularly regarded, by *Phyſicians* and *Surgeons*, yet did there ſtill remain Difficulties almoſt inſurmountable, to the entire clearing them

them up, and particularly the *Cataract*. This bold Task I have attempted, tho' *a laborious Work*, and *worthy* of *a better Pen!* I had the Honour of laying it before You, ſoon after my quitting *Paris*, tho' then almoſt in it's Infancy ------- You, SIR, were pleaſed to think the Attempt laudable, and the Performance not unworthy publick Notice. The Countenance of a Gentleman, deſervedly the Head of his Profeſſion, and the *Hippocrates*

of

of the preſent Age, could not but raiſe a ſtrong Deſire in me really to merit Your Eſteem. Spurred on by this Principle, I have with incredible Labour and Perſeverance, purſued the Attempt; and found, however beaten the Subject, my Pains amply rewarded by the Diſcoveries I have made.

But tho' the Approbation of a College of *Phyſicians*, would no Way raiſe the Eſteem of ſuch a Thing in You;

You; as being Yourſelf a thorough Judge of Merit; yet it would certainly make the World, look with more Deference on ſuch a Performance. It was on this Account, that I laid the Manuſcripts before Dr. *Barry, Preſident* of the College of *Phyſicians*, for their *Examination*, who had been previouſly acquainted of it, by Letter, from one of the *Cenſors*, and my honoured Friend. But tho' it remained there for above a Week,

and

and that there had been a full Aſſembly of that learned Body, in the *Interim*, before whom I propoſed to demonſtrate the Facts herein contained; yet I found they had *neither Time, nor Curioſity* *, to ſee thoſe Things; and they declined approving of it, becauſe looking over the Authors here quoted, would take up too much Time. Thus much I thought proper to inſert, in my own Defence. But it is certain,

* *Hequet*'s Anſwer to Dr. *Petit*'s Letter.

tain, that a good Performance needs not Commendation; and a bad one, uſhered in with how pompous an one ſoever, will not be ſufficient to protect it. The Truth of the latter Part of this Aſſertion, thoſe Gentlemen can atteſt, and the former needs no Proof.

But tho' I had not the Pleaſure of their Approbation, yet I doubt not, but the Attempt I have made, to reſcue ſo valuable a Branch of

DEDICATION.

Phyſick, from the Hands of *Empiricks,* will meet with the Applauſe of every *Phyſician* and *Surgeon.* Your kind Acceptance and Protection of it, will be my greateſt Honour, and a ſufficient Guard, from the Snarlings of invidious *Criticks.* I have the Honour to be, with great Reſpect,

SIR,

Your moſt Obedient

Humble Servant,

Limerick, Jan.
1ø. 1749.

SIL. Ô HALLORAN.

A

CATALOGUE

OF

BOOKS,

Made Use of in the following TREATISE.

A.

ACTA Medico-physica Natur. Cur.
L'Academie Royale des Sciences, les Memoires.
Aquependente, Traité de la Chirurgie.
Arculanus in Rhasin,

B.

Boyle's Philoſophical Works.
Borrichius, de ſapientiâ Ægyptorum.
Briggii Opthalmographia.
Briſſeau, Traité de la Cataracte.

C.

Camper Diſſertatio Medico-phyſica, &c.
Carteſii opera.
Celſus.
La Charriere, ſa Chirurgie.
Cheſeldon's Anatomy.
---------- Philoſophical Tranſactions.

D.

Dionis Cours de Chirurgie.

E.

Edenburgh, Medical Eſſays.

Friend,

F.

Friend, Hiſtoria Medicinæ.

G.

Graveſend's Mathem. Elem. N. P.
Gaſſendi opera.

H.

Harvey, de ſanguinis circulat.
Heiſterus de Cataractâ & Glauc.
---------- Apolog. Tractat. Chirurg.
Hecquet, ſur l'utilité de la ſaignée, &c.
Hovius, de circul. humor. motu in oculis.
Hugenii Dioptrices.

I.

Journal des Savans.
Jeſus, Hali opera.

K.

Kepleri Dioptrices.

L.

Lemnius, de Miraculis Naturæ.
Litre, Memoires de l'Academie.
Le Cat, Traité des Sens.
Le Dran, ſur les differentes manieres de tirer la pierre, &c.
Lewenhoeck, Philoſophical Tranſactions.

M.

Martin's Opticks.
O Mara, Examen Diatribæ Thomæ Williſii.
Mery, Memoires de l'Academie.
------ ſur la maniere de tailler de Frere Jaques.
Mayernia, Praxeos Med.
Molyneux, Philoſophical Tranſactions.
Morand, Memoires de l'Academie.

Newton's,

N.

Newton's, Sir Iſaac, Opticks.

O.

Oribaſius Sinops Med.

P.

Palfin, l'Anatomie Chirurgicale.
Petit, Phyſician, Memoires de l'Academie.
——— Letre des reflexions, &c.
——— ——— ſur la vray ſituation du Cryſtalin.
Petit, Surgeon, Memoires de l'Academie.
Plempii Opthalmograph.
Porterfield, Medical Eſſays of Edenburgh.
Pemberton, Diſſertat. Medic. phyſ.

Ranby,

R.

Ranby, Philoſophical Tranſactions.
Riverii Praxeos Med.
——— Obſervat.
Rolfoncius.
Read, on Diſorders of the Eye.
Ruyſchii Theſaur. Anatom.
Rohaulti Phyſic.
Renault's Entretiens phyſiques.

S.

St. Yves, les Maladies des Yeux.
Scheuchezer, Acta Medic. phyſic.
Smith's Opticks.

T.

Taylor, le Mechaniſme du Globe de l'œil.
——— Syllabus of Diſorders of the Eye.

Winſlow,

W.

Winflow, Expoſition Anatomique.
---------- Memoires de l'Academie.
Widelius, de Cataractâ.
Woolhouſe, Diſſertations ſavantes & critiques, ſur la Cataracte, &c.

A PRE-

A

PREFACE.

IF a luxurious Way of living, was the Riſe, and is the Continuance, of ſo many Diſorders, to which People are daily expoſed, as Seneca *has juſtly remarked; Temperance, and an abſtemious Way of living, may certainly help to leſſen them. But tho' this Doctrine will hold good in other Diſorders, yet it will never anſwer in thoſe of the Eye; ſeeing that the*

Poor are equally, if not more expoſed to them than the Rich. It is, perhaps on this Account, that the Eye *has ſeemed always to draw a more particular Attention from medical Writers. Even from the Times of* Hippocrates, *it has been handled with particular Exactneſs. Nay ſome imagine* (1) *that the Operation of a* Cataract *was known to the* Egyptians *above three thouſand Years ago; ſeeing that* Herodotus *ſays, that* Cambyſes *ſent an* eminent

(1) Borrichius de ſapient. Ægypt. p. 205.
Heiſterus de Cataractâ, p. 286.

eminent Oculiſt *of* Egypt, *into* Perſia, *to cure* Cyrus.

Celſus, *who was certainly no great* Anatomiſt, *has deſcribed the* Cataract *ſo exactly, and it's Operation ſo well* (2), *that what has been ſince writ on that Subject, has been little better than a bare Tranſcription of his Words; and nevertheleſs he flouriſhed in the Times of* Tiberius, *that is, immediately after the Birth of* Chriſt.

Aetius *was ſtill more exact in his Deſcription of the*

(2) Lib. vii. cap. vii.

Diſorders of the Eye. Hippocrates *and* Celſus *number about thirty Diſorders incident to this Organ, as the learned* Friend (3) *obſerves; and* Galen *a few more; but this Writer recites above twice that Number of Diſeaſes; and their Symptoms and Cure, he very accurately deſcribes; and of which above thirty require manual Operations. Amongſt the* Greeks, *next after* Aetius, Paulus *and* Alexander *certainly writ the beſt on thoſe Diſorders.*

But

(3) Hiſtor. Medicinæ, p. 139, 219.

But the Arabians *brought the Knowledge and Cure of thoſe Diſorders into much greater Perfection.* Rhaſis *who practiſed Phyſick with great Applauſe at* Bagdad, *or* Babylon, *about the Year* 900, *wrote ſeveral learned Treatiſes; and in particular, in his Ninth Book,* De Curatione omnium Partium, *he treats very largely of the Diſeaſes of the* Eye. *In his Eighteenth Chapter, he diſcourſes of the* Opthalmia, *and the different* Species *of it: In this Chapter alſo, he gives a juſt, tho' conciſe* Anatomical *Deſcription of*

of the Eye; *and particularly takes Notice of the* Tunica Aranea, *which ſurrounds the* Cryſtalin-Lens. *In the Thirtieth Chapter, he gives a large Account of the* Cataract, *and it's Cure; and deſcribes the Operation with great Exactneſs; directing the Needle to perforate the* Eye, *about three Lines Diſtance from the* Cornea, *and leaves no Diſorder of this Part unnoticed.*

Jeſus Hali, *a learned* Arabick *Phyſician, wrote extremely well upon the Diſeaſes of this Organ; tho' the learned* Friend, *neither fixes the*

the Time of his Writings, nor yet gives any Account of his Works, only juſt obſerves; "Sunt et alii auctores Arabici, quorum libri extant, "ut Abbenquenfit, Bulcaſem, Jeſus Hali, Cammanuſali, Rabbi Moſes, "&c. quos cum nihil memorabile in ſe habeant, et "id mihi in animo ſit, ut "medicinæ potius, quam "medicorum hiſtoriam con"texam, ſilentio præter"mitto." Hiſt. Med. p. 257.

He inſiſted, that all Cataracts *were formed in the* anterior Chamber *of the* Eye; *that*

that is to ſay, between the Cornea-Tranſparens *and* Iris; *and of Conſequence, that the Needle ſhould never perforate the Coats of the* Eye *poſteriorly. But if, ſays he, in the Operation, the* Cataract *ſhould ſlip between the* Cryſtalin *and* Iris, *in this Caſe, the Needle may paſs into the* poſterior Chamber *of the* Eye, *and ſo bring it back, and depreſs it under the* Cornea; *and in this Caſe, he affirmed, that the* Pupilla *was capable of a very great Diſtention, which would immediately contract itſelf on the Removal of the Extraneous Body, in the ſame*

Manner

Manner as the Matrix *does, immediately after Delivery. And to support this Assertion, he affirmed, that were it between the* Iris *and* Crystalin, *it was impossible to remove it, without affecting this Part, and of Consequence, depriving the Patient of Sight. By this it appears, that* Aquependente *was not the first who affirmed,* That it was impossible to introduce the Needle into the *posterior Chamber* of the *Eye,* without wounding the *Crystalin. This Opinion was also embraced by* Albucasis *and* Mesue; *on the contrary,* Azaravius, *whom Doctor*

Friend *confounds with* Albucaſis, *was of the contrary Opinion; that is, that there were no* Cataracts, *but ſuch as were formed between the* Cryſtalin *and* Iris.

To reconcile thoſe different Opinions, Arculanus, *an eminent Phyſician of* Verona *in* Italy; *and who, according to* Friend, *lived in the fifteenth Century, allows of both Sorts of* Cataracts (4). *He ſays, that a* Cataract *may be formed in the* anterior Chamber *of the* Eye, *when the Matter, which*

(4) Arculanus in Expoſ. nonor. libr. Almanzoris.

which ſhould nouriſh the Dura-Mater, *is not in a good State; or from too great an Abundance of it, or moiſt Exhalations. In all thoſe Caſes the Matter may tranſude thro' the* Sclerotica; *and thus, by a Sort of Accumulation, form a* Cataract *between the* Cornea *and* Iris; *and thoſe in the* poſterior Chamber *of the* Eye, *he thinks proceed from a Defluxion of Matter from the* Pia Mater.

Not to mention the numberleſs Writers on this Part ſince, as Riverius, Sennertus, Rolfoncius, Plempius, *&c. it has entirely employed*

the Learned, ſince the Beginning of the preſent Century. *In thoſe Diſputes, which are related at large in the Beginning of this Work, the Structure and Mechaniſm of the Eye, were ſo accurately handled, on both Sides, that it ſeemed impoſſible for any thing new to be ſaid on this Subject. Beſides this, not to mention the pretended Diſcoveries of* Nuck, *and* Ruyſch. Hovius, *who aſcribes the Merit of all thoſe to himſelf, has writ an entire Book, barely to ſhew the Circulation of the Humours in the* Eye. *'Tis this ſame, who pretends to ſhew the* Choroides

Choroides *compoſed of five* Laminæ, *or Membranes, and nevertheleſs declares the* Cataract *to be a Membrane, formed between the* Cryſtalin *and* Iris!

Petit, *formerly a celebrated Phyſician of* Namur, *and ſince of* Paris, *has profeſſedly laid himſelf out for Diſcoveries in the Anatomy of this Part, and not unſucceſsfully.* Winſlow *alſo has not been wanting for Diſcoveries in this, as well as in every other Part of the human Body.* Morand *the Son, has alſo given Obſervations and Remarks on the Eye, and it's*

it's Diſorders, not unworthy of himſelf. So has the learned Profeſſor Ferren, *of* Paris, *in his* Anatomical Lectures. *Mr.* Cheſeldon *has been very indefatigable in his Searches too; and propoſes a very curious Operation,* viz. the making an artificial Pupilla. *Mr.* Ranby, *Serjeant Surgeon to his Majeſty, has likewiſe given ſome Remarks on the* Cataract *in the* Philoſophical Tranſactions *for* 1730.

But beſides all thoſe, ſcarce a Winter paſſes, in which ſome Theſes *are not ſuſtained at* Paris, Montpelier, *or* Leyden,

Leyden, *on this Subject: Yet are there some on these Occasions, which should not be forgot; such is the* Dissertatio Physico-Medica *of Doctor* Pemberton, *addressed to the learned Doctor* Mead; *as also the* Dissertation *of Doctor* Camper, *in* 1744, *on the same Subject. Besides an accurate Description of the* Eye, *and the Uses of it's several Parts, according to the received Opinion; he also gives a Figure of the* Canal Godronnée, *of* Petit; *as also a Description of the true Situation of the* Eyes *in their Orbits, contrary to the Opinion*

nion of a very celebrated Anatomiſt.

By what has been ſaid, it will appear, how difficult a thing it is to write any thing new on this Subject. Yet I am very confident, that the curious Reader *will find ſeveral Diſcoveries well worth his Attention in the following Sheets.*

Beſides putting an entire End, to the Diſputes, about the Seat of a Cataract, *which thing alone, has been the Occaſion of great Conteſts in the learned World, the different Opinions, about a* Glaucoma,

coma, *and* Cataract, *are also entirely confuted; not by barely saying they were the same; but by examining the Opinion of each Author on this Subject, and at the same time shewing, how he was deceived. Perhaps some may think, that I have spent too much Time on this Head; but I have been the more particular in it,* first, *to avoid the* Criticisms *of People, who, though they might be convinced in their own Mind, yet, for the sake of Contradiction, or to draw the Attention of the People on them, might be the Occasion, by taking up the Pen, of more unnecessary*

physical Lumber: Secondly, *because it is a thing of such necessary Consequence to Mankind in general, and in particular, to the* practical Surgeon, *to know,* that all Opacities are at all times equally curable; *seeing that by this, he is not to wait for one particular Time or Season; or till the Fruit is ripe and fit to be plucked off, as St.* Yves *pedantically expresses it.*

As for the small Difference of Refraction, between the Crystalin-Lens *and* Vitreous-humour, *I think I have evidently proved it, both from* Opticks, *Reason, and (which is*

is ſtill more convincing) indiſputable Facts. I have alſo pretty manifeſtly ſhewn, that there is not any Adherence of the *Ligamentum-Ciliare,* to the *Cryſtalin-Capſula.* Keplerus *in his* Dioptricks *was the firſt who advanced, that the different Figures the* Eye *took, were occaſioned by the Attaches of the* Ligamentum-Ciliare, *to the* Cryſtalin. *This, tho' it was a curious Remark for a* Phyſician, *(I mean a* Philoſopher) *was implicitly ſubmitted to, by all* Phyſicians, *and* Mathematicians *ſince; nay ſome (prompted by a laudable Zeal) went further, even to diſpute with*

him the Diſcovery; being aſhamed to ſay, that ſo curious a Remark ſhould be made by any one, but an Anatomiſt.

Hovius's *Book, I have alſo examined; not indeed out of any Deſire of being thought a* Critick, *but barely to ſearch out (if poſſible) the Truth; ſeeing that the learned World are much indebted to him, for his Diſcovery of the Blood-Veſſels of the* Eye; *tho' indeed, I believe, if People were leſs curious in enquiring into the firſt Cauſes of Things, we ſhould find* Phyſick *at a much greater Perfection than it now is;*

is; seeing that some People shall spend whole Months, nay Years too, to find out a Reason, why a Muscle *acts, the* Heart *contracts, or if Sensation be made, by the* Animal Spirits, *or a* vibratory *Motion of the* Nerves; *and yet shall be often at a Loss, to shew or describe a* Muscle, *a* Nerve, *&c.*

I have also given an Account of this Operation, as it has been practised by the most eminent Surgeons; *and have examined into the Merits of each of them, and shewed where they were deficient. I had indeed some Thoughts, to have*

have given an Anatomical Deſcription *of the* Eye, *and afterwards to have examined the different Operations for a* Cataract; *in Imitation of that celebrated Piece of M.* Le Dran's (5); *but beſides that this would confine me too much, from the general Remarks, which are interſperſed thro' this Work, I ſhould be alſo obliged to repeat ſeveral Things, already ſaid over, and over again: 'Tis for thoſe Reaſons, that I have publiſhed this Piece, as you ſee it; leaving it to others to make Uſe of the different Remarks on*

(5) Parallele des differentes manieres de tirer la pierre, *&c.*

on the real Structure of the several Parts of this Organ, *as by repeated Experiments I have found, and here described them. The Method of dissecting an Eye, will, I flatter myself, be not unacceptable to the Curious; seeing that by it every Man may examine the different Parts of this Organ, and see those Discoveries, which, by any other Method, could not be found out.*

As for the Cuts *annexed to this Work, I took Care to have them finished in the most exact Manner; and in this my Trouble was so much the*

greater,

greater, ſeeing that I was obliged (in order to ſhew the Parts as they really were) to paint this Part in a Manner quite different from what it had been heretofore repreſented; and this I thought was the more neceſſary to be done, ſeeing that by one Glance of an Eye, *a Man can immediately form a juſt Notion of this Part; as alſo the more readily comprehend the ſeveral Remarks,* &c. *interſperſed thro' this Work. In a Word,* Reader, *as my ſole View has been nothing but Truth, ſo I have ſpared no Pains or Labour to come at it. 'Tis upon this Account, that*

that I have not once attempted to advance any thing without first manifestly proving it; and if I have sometimes differed from several great Men, it has been only where Facts have obliged me to it. I have endeavoured thro' the Whole, to convey my Thoughts in the most clear and easy Manner, without giving Offence or Scandal to any one, who has differed in Opinion from me.

If then, it will please the curious Lovers of Truth and Certainty, and encourage others to search deeper into those Af-

fairs, it will answer the Intent, for which I purposed it.

Limerick, the 12th of
April, 1749.

S. Ô H.

AN

ACCOUNT

OF THE

DISCOVERIES, &c.

Made by the AUTHOR, in the following TREATISE.

1. THE *Cataract* is, *ever* an Opacity, in the *Cryſtalin-body* only.
2. The *Glaucoma*, not a different Diſeaſe, but a different Name to expreſs this Diſorder by.
3. *Phænomena* conſequential to this Operation, explained.
4. The Cure of a *Cataract* ſhewn.
5. The different Motions, in the Globe of the *Eye*, occaſioned by the Action of the *Choroides Anterior*.

6. A

6. A Muſcle has different Degrees of Contraction.
7. No Circulation of the Humours in the Eye.

Anatomical Diſcoveries.

8. The *Iris* compoſed of Radial Fibres only.
9. The *Vitreous-humour*, not ſurrounded by any proper Membrane.
10. The *Cryſtalin-Lens* has no Adherence to the *Ligamentum-Ciliare*.
11. A Subſtance, partly *cartilaginous* and *boney*, in the internal Angle of the Eye, which I have called *Os Opthalmicum*.
12. The Origin of the *Aqueous humour*.
13. Why the Eye is ſubject to Inflammation, in Conſequence of couching.

14. The

14. The true Situation of the *Cryſtalin-Lens*, and *Choroides Anterior*.
15. A Deſcription of the *Ligamentum-Ciliare*.
16. *Koreotomy* impracticable, as deſcribed.
17. A different Method for performing this Operation propoſed.

ERRATA.

Page 32. *line* 3. *for* Parallel Rays, *read* Perpendicular Rays.
P. 43. *l.* ult. *for* Lamina, *r.* Laminæ.

OF THE

GLAUCOMA,

OR

CATARACT.

I. THIS Diſorder is, by the *Latins*, called *Suffuſio*; but it is more generally known by the Name *Cataracta*; which, according to *Livy*, ſignifies *Gates*, or any other Obſtacle to the Entrance of Towns, more eſpecially fortified ones: Others will have it to be derived from καταῤῥέω, *defluo*, *delabor*; others again from κέρας, *Cornea*;

nea; or, perhaps, from κατα *contra* και, Κορη, *Pupilla*. By *Paulus*, and other *Greeks*, it is called ὑπόχυμα, *liquefacere*. Others again diſtinguiſh between a *Suffuſion* and *Cataract*, (1) in calling the *Suffuſion* a *beginning Cataract*; and the *Cataract* a *confirmed Suffuſion*.

II. But, let it's Derivation be what it will, all agree, that the *Cataract* is, *a Loſs of Sight, with a Change of the natural Colour of the* Pupilla, *or* black, *into ſome other Colour*; *as for Inſtance, to* white, gray, yellow, *&c.* By this Definition, or rather Deſcription, it is eaſily diſtinguiſhed from other Diſorders, incident to this Organ. It is known from the *Amauroſis*, becauſe in it, the Sight is loſt, without any Alteration in the Colour of the *Pupilla*;

(1) Praxeos Mayern in morb. intern. c. xiii.

pilla; from the *Leucoma*, becauſe in this, 'tis the *Cornea* that is rendered *opacous*. From the *Pterygion*, as it is a Membrane, that covers the *Cornea tranſparens*. It is known, from the *Hypopyon*, as this laſt is purulent Matter, collected between the *Cornea* and *Iris*, and fluctuating; when, on the Contrary, the Opacity in the *Cataract*, ſeems ſolid, and behind the *Pupilla*. And here I ſhould with a great deal of Perſpicuity, endeavour, according to Cuſtom, to diſtinguiſh between this Diſorder and the *Glaucoma*; but as I ſee very little Reaſon; (or rather none at all, as I ſhall ſhew preſently) for ſuch Diſtinction, I ſhall, with the Antients, eſteem *Glaucoma et* ὑπόκυμα *unum eundemque morbum eſſe*, as *Oribaſius*, *Synops. Med. lib.* viii. remarks of them.

III. But tho' the Fathers of Phyſick, had called all Blindneſs with a Change in the Colour of the *Pupilla*, indifferently, *Cataracts*, or *Glaucoma's*; yet Experience ſatisfied their Succeſſors, that there was a great and eſſential Difference between them: the one being a Diſorder, which admitted of a Cure, by the Operation; and in the other, the Operation ſerved only to remove the Deformity in the Eye, without adding any thing to the Sight; which *Oribaſius* alſo remarks, by ſaying, *Glaucomata omnia, curationem non recipiunt*, &c. And as thoſe Opacities which they found irremediable, ſeemed moſtly of a grayiſh blue, or Sea Colour; they only were called *Glaucomata à* γλαύκος *Canus, vel, quaſi glauci coloris*; and the curable ones, *Cataracts*.

IV. They

IV. They therefore then unanimouſly agreed, that the *Cataract* was an Opacity, occaſioned by ſome Pellicle or Membrane, formed in the poſterior Chamber of the Aqueous-humour, which they ſuppoſed to be much more capacious than the anterior; and the *Glaucoma* the *Cryſtalin-Lens* affected; for as this Body was looked upon, as the moſt eſſential to Viſion, they concluded, that it only was affected in the *Glaucoma*; and, of Conſequence, Sight inevitably loſt.

V. The firſt who attempted, with Succeſs, to ſhew the true Seat of a *Cataract*, were, Meſſieurs *Briſſeau*, *Antoine Maitre-Jean*, and *Heiſter*: The firſt in his *Traité de la Cataracte & du Glaucôme*, *Paris* 1709: The next in his *Traité des Maladies de l'œil*, *Troyes* 1707; and the laſt in his *Tractatio de Cataractâ & Glaucomate*,

Glaucomate, *Altorfii*, 1713. Nor ſhould we, on this Occaſion, forget *Petit* the Phyſician, who has proved from Experience, (*La Traité de Briſſeau*, p. 161) and the Structure of thoſe Parts, (the poſterior Chamber of the Eye, being but $\frac{1}{4}$ of a Line) the Impoſſibility of the Exiſtence of a membranous *Cataract* there. *Voyez ſa letre, où il demontre, que le Cryſtalin eſt fort près de l'Iris.*

VI. The firſt Obſervation was made by *Briſſeau*, in 1705, on a Soldier, who laboured under a perfect *Cataract*. This Man, happening to die of a Flux, *Briſſeau* depreſſed the *Cataract*, on the Body, with the ſame Precautions, as if on a living Subject, till ſuch times as he ſaw the Opacity removed from behind the *Pupilla*. He then takes out the *Eye* from it's Orbit, in order to examine the Body he had depreſſed.

He

He therefore opens the *Cornea*, and after the *Aqueous-humour*'s having discharged itself, he found, instead of a *Membrane*, the *Crystalin-Lens* itself *opacous*, and depressed under the *Vitreous-humour !* To be more certain, he opens the other *Eye*, and found the *Crystalin-Lens* transparent, and in it's natural Place.

VII. This remarkable Observation confirmed by very strong Arguments, was read before the *Royal Academy* the Eighteenth of *November*, of the same Year. But the *Academians* seemed to make slight of this Discovery; nor did they think proper, to give it a Place in their Works. However this cool Reception did not deter *Brisseau* from maintaining his new Opinion, *viz.* That it was the *Crystalin-Lens*, *which was constantly obscured in the Cataract*; and therefore,

VIII. In

VIII. In 1708, he publiſhed four Caſes more, to confirm his new Doctrine; in each of which he conſtantly found the Opacity, to be in the *Cryſtalin* Body itſelf, as in his firſt Experiment; and differing in nothing from it, except in the Degrees of Colour and Conſiſtence in this Body; as being ſometimes harder, ſometimes whiter, or yellower; but *never* a *Pellicle* formed in the *Aqueous-humour*, as was before imagined.

IX. In 1709, he collected all thoſe Pieces which he had ſeparately publiſhed on this Affair; added to them ſeveral new Obſervations, both of his own and others; and, in a Word, ſeemed to make the true Seat of a *Cataract* indiſputable. But as this was a great Innovation, with reſpect to the then received Opinion, of the Uſes aſſigned to the *Cryſtalin-*

Cryſtalin-Lens; it did not fail of raiſing him a great many Enemies, both Phyſicians and Mathematicians; amongſt whom, *de la Hire* the Father, *Litre* and *Mery*; (2) and the noted *Engliſh* Oculiſt, *Woolhouſe*, (3) were his greateſt Opponents.

X. Nor was *Maitre-Jean* wanting to confirm this new Doctrine by Facts. In Pag. 115, *&c.* you have two Hiſtories: The firſt, of a Perſon who died, labouring under a perfect *Cataract*; and on whom the Operation was not made. In examining this *Eye*, he found the *Cryſtalin-Lens* in it's natural Place, but *opaque*; and as if infuſed in ſome *acid* Liquor. The other was of a Woman, on whom the Operation had been ſucceſsfully perform-

C ed,

(2) Memoires de l'Academie, 1706, 7, 8.
(3) Diſſertations ſçavantes & critiques, &c. Memoires des Trevoux, &c.

ed, for *both Eyes*. This Woman, dying some Time after, he examined *both Eyes*; and found in each, the *Cryſtalin-Lens opaque*, and lying under the *Vitreous-humour*; and this laſt Convex in it's anterior Part, and occupying the Place of the *depreſſed Cryſtalin*.

XI. However, it is to be noticed, that tho' *Briſſeau* and *Maitre-Jean*, were the firſt, who *evidently* demonſtrated the *Cataract*, to be an *Opacity* of the *Cryſtalin-Lens*; yet they were not the firſt, who made that Obſervation. For M. *Laſnier*, an eminent Surgeon of *Paris*; and who died in 1690, made the ſame Remarks, forty Years before. And tho' he was countenanced in this Opinion, by *Rohault*, (4) and *Gaſſendus* (5); and that in

(4) Rohaultus in tractatu ſuo phyſico, Pars I. cap. xxxv.

(5) Gaſſendi opera, Tom II. p. 371.

in a little *Analyſis* of *Mariotte*'s, *Nouvelles Decouvertes, touchant la Vuë*, it was publickly aſſerted, " That Oculiſts had found, that " there was no other Way, of cu- " ring that *Diſorder* of the *Eye*, " called *a Cataract*, but by de- " preſſing the *Cryſtalin*," &c. (6) Yet it was not ſufficient, to gain it any Eſteem, in the World.

XII. But, becauſe I ſee, not only *Litre* and *Woolhouſe*, to argue for *Membranous Cataracts*; but alſo *Heiſter*, who wrote with ſo much Spirit and Learning againſt this Doctrine, in his *Syſtem of Chirurgery*, own, that there are *Membranous* as well as *Cryſtalin-Cataracts*. I obſerve, that there are none, but *Cryſtalin-Cataracts*; becauſe of the ſmall Space of the *poſterior Chamber* of the *Eye*, (N. V.) which in all

(6) Journal des ſçavans, 1668.

Situations and Poſitions of the *Eye*, is conſtantly the ſame; as may be more fully ſeen, by Mr. *Winſlow's Memoire*, in *The Works of the Academy for* 1721; or by conſidering the real Situation of the *Cryſtalin-Lens* and *Iris*; which are truly repreſented in the Plates, annexed to this Work. *See Plate* I. *Fig.* I. *and* II.

XIII. But becauſe I ſee St. *Yves* (7) goes farther, in pretending to give Signs to diſtinguiſh, between a *Membranous* and a *Cryſtalin-Cataract*; by obſerving that in the former, it will appear flat, and hollow in it's Center, by looking thro' the *Pupilla*; when, on the Contrary, in the *Cryſtalin-Cataract*, the Opacity ſeems more elevated in it's Center. But this, I anſwer, is no true Sign, to know them by, were there

(7) Les maladies des yeux, chap. xviii.

there any ſuch *Cataracts*; becauſe, amongſt the Number of *Eyes*, which I have diſſected, I have met with *two* that were *cataractous*, each of which ſeemed to anſwer to St. *Yves*'s Deſcription of a *Membranous Cataract*; being quite flat in the Middle. But upon examining them, I could eaſily perceive the *Cryſtalin Capſula*, tho' dented in, for Want of a ſufficient Convexity in this Body; and the *Cryſtalin* partly diſſolved. But what principally formed the Opacity, was, that it was divided into three Parts, each from the Center; (juſt as this Body will do, when laid in Water, for a Couple of Days; and which was *Hovius*'s Method of examining it) (8) with the more fluid or diſſolved Parts interpoſed; tho' each of thoſe Parts, when ſeparately examined, ſeemed tranſparent.

(8) Conſule Hovii opera, tab. iv. fig. iii. fig. iv. in tab. v.

tranſparent. Since I had firſt the Opportunity of making thoſe Remarks, I have met with ſeveral *Eyes*, which anſwered to the ſame Deſcription; and I find, that this is, the Sort of *Cataract* that generally attacks old People.

XIV. However, tho' moſt People are now well ſatisfied, that, the *Cataract* is a Diſorder of the *Cryſtalin*; and that this *Diſorder* is remediable by the *Operation:* Yet they are far from agreeing, to the Seat of a *Glaucoma*. All conclude, that it is a *Diſorder* that widely differs from a *Cataract*; becauſe this is remediable by an *Operation*; when, on the Contrary, in the *Glaucoma*, the *Operation* is of no further Service, than to take off the *Blemiſh* in the *Eye*, without in the leaſt contributing to the reſtoring of Sight. For as it had been a received Opinion, that the *Cataract* was a *Pellicle*

licle formed by the *Aqueous-humour*, in the ſame Manner as is remarked of Wine or Vinegar, tending to Putrefaction, which forms a Skin on it's Top; ſo by depreſſing this *Membrane*, Sight was reſtored. But the *Glaucoma*, as an *incurable Diſorder*, they placed in the *Cryſtalin-Lens*. But, as later Experiences have proved, the *Cataract* to be a *Diſorder* of the *Cryſtalin*, they have ſtill thought fit to keep up the Diſtinction; each deſcribing the *Glaucoma*, as Caprice or Fancy led him to think of any other Diſorder, which, joined to a *Cataract*, might ſtill keep the Perſon blind; tho' no Matter whether ſuch a complicated Diſeaſe exiſted in Nature.

XV. Tho' all agree to the Exiſtence of a *Glaucoma*, or *incurable Cataract*, yet they are far from agreeing to it's Seat, or the *pathognomonic* Signs of it. It is by all Sides

Sides affirmed, to be a Diſorder that ſeldom happens, which *Widelius (in Diſſertatione de Cataractâ)* notes, in ſaying, *Quinquaginta ſenes, Cataractâ laborantes videbis, quam unum, Glaucomate ſtrictè ſumpto.*

XVI. *Maitre-Jean* (9) ſays, that a *Glaucoma* differs in this from a *Cataract*, that, beſides the Opacity of the *Cryſtalin-Lens*, there is alſo a Hardneſs and Drineſs of this Body; and this Hardneſs, and Opacity, or, with him, *complicated Cataract*, is a *Glaucoma*, or, *incurable Diſeaſe*. But, as it is evident, that what *Maitre-Jean* calls a *Glaucoma*, is remediable by the *Operation*, therefore his Difference is not good, ſince he agrees with the reſt, that the *Glaucoma* is incurable. 'Tis for the ſame Reaſon, that we reject *Woolhouſe* and *Mery*'s Opinion.

XVII.

(9) Les maladies de l'œil, p. 204, &c.

XVII. *Briſſeau* (1) ſays, that this Diſorder is an Opacity of the *Vitreous-humour*, joined to a *Cataract*; ſo that in this Caſe, altho' you depreſs the *Cryſtalin*, yet the *opaque Vitreous-Tunick* ſtill hinders a Paſſage to the Rays of Light. To illuſtrate which, you have the Hiſtory of *M. Bourdelote*, the King's Phyſician, who had for ſome Years laboured under a perfect *Cataract*, in one of his Eyes. At his Death, he ordered, that the diſeaſed Eye ſhould be examined, in order to clear up the Diſputes about the true Seat of a *Cataract*. This was done by *Mareſchal*, the King's firſt Surgeon; who found the *Cryſtalin-Lens opaque* and *ſolid*, with it's *Nucleus*, or *Center*, of a more ſolid Conſiſtence, and yellower Colour than it's Circumference: The *Si-*

 nus,

(1) Traité de la Cataracte, & du Glaucôme.

nus, or *Cavity*, of the *Vitreous-humour*, in which this Body was lodged, was clouded almoſt a Line in Depth; and this he concludes to be a *Glaucoma*; becauſe, ſays he, tho' the *Cataract* were depreſſed, yet the Opacity of the *Vitreous-Membrane* would ſtill ſtop up the Paſſage of the Light: Therefore this agrees with the Obſervations of moſt Authors, in it's being, *an incurable Diſorder*.

XVIII. The learned *Heiſter* (2) is very zealous to preſerve a Diſtinction between thoſe two Names. He obſerves, that the *Glaucoma* is an Opacity of the *Vitreous-Tunick*; and concludes, that the above Caſe, mentioned by *Briſſeau*, to be that of a true *Glaucoma*: Hence he concludes, that an Opacity of the *Cryſtalin-Lens*, as a *curable Diſorder*, anſwers

(2) Tractat. de Cataractâ & Glaucomâ.

anſwers beſt to the Name of a *Cataract*, but moſt improperly to that of a *Glaucoma*.

XIX. St. *Yves* (3) imagines to have diſcovered the true Difference between thoſe Diſorders.--He denies, againſt *Mery* and *Woolhouſe*, the Seat of a *Glaucoma* to be in the *Cryſtalin-Lens*; nor does he better agree with *Heiſter* and *Briſſeau*, in aſſigning it to the *Vitreous-humour*. He affirms, "that by a cloſe In-"ſpection into *Eyes* affected with "this Diſorder, he found a kind of "Change in the *Cryſtalin-Lens*, "which came upon a *Palſy* of the "*Ciliary-Nerves*." Or, a Glaucoma *is a* Cataract *joined to a* Gutta Serena.

XX. *Taylor* (4) defines the *Glaucoma* to be a Diſorder, wherein, not only

(3) Les maladies des yeux, chap. xvi.
(4) Le mechaniſme du globe de l'œil. Syllabus of the Diſorders of the Eye.

only the *Cryſtalin-body* is affected, but it's *Capſula* alſo: It's Colour, of a *Sky-blue*, and the *Pupilla immobile*; and according to his wonted Manner, makes three different Species of it; none of which, I dare be bold to affirm, ever came under his Cogniſance. In the ſecond, he ſays, there is, not only an Opacity of the *Cryſtalin-Lens*, and it's *Membrane*, but that this Body is alſo augmented, ſo as to puſh the *Iris* forwards. In the third Sort, this Body is ſo much increaſed in Quantity, as to fill the two Chambers of the *Eye*.

XXI. Now the Diſputes, which have ſo long exiſted, with reſpect to the *Cataract*, were not occaſioned about the true *pathognomonic* Signs of this Diſorder; becauſe all have agreed, that it is ſome *opaque* Body, which, lying behind the *Pupilla*, obſtructed the Paſſage of the Light. —Their Diſputes then, were only about

about the Parts which were rendered *opacous*; which, tho' they helped in a great Measure, to the more fully clearing up of this Disorder; yet changed nothing, with respect to the Operation. But, with regard to the *Glaucoma*, it is quite otherwise; which all will have to be a Disorder very different from a *Cataract*; tho' we have no certain Signs to distinguish them from each other; nor any certain Reason for such Distinction.

XXII. *Heister* and *Brisseau* imagine this Disorder, to be the *Vitreous-humour* affected, as was the Case of M. *Bourdelote*; but if I shall shew you, that those Appearances in his Eye, were occasioned by Inattention to the Structure of this Part only; you will then, I hope, conclude with me, that they knew not the Difference between those Disorders.

XXIII. But

XXIII. But, becauſe I ſee the learned *Heiſter* give particular Signs, (which indeed are no more, than what *Riverius* and *Sennertus* gave before him) to diſtinguiſh between thoſe Diſorders; I think I cannot paſs by, without taking Notice of them. The *Glaucoma*, ſays he, being an Opacity of the *Vitreous-Membrane*, it appears thro' the *Cryſtalin*, as if a Body, like Adamant, or clear Glaſs, were lodged there; and, by ſeeming to lie further back, behind the *Pupilla*, than the *Cataract* commonly does. *Tract. de Catar.* fol. 165----242, &c. In folio 260, he gives two Hiſtories to this Purpoſe: The firſt, of a Man blind of *both Eyes*, who *Vaillant*, an eminent Surgeon of *Amſterdam*, undertook; *but tho'*, ſays he, *we could plainly ſee the* Needle *move, behind the* Pupilla; *yet this ſhining* Opacity *was far beyond the* Needle,

and

and could not be removed, or ſuppreſſed; and therefore the *Operation* did not *ſucceed*: Another ſuch-like *Operation*, performed by *Bortelius*, was equally *unſucceſsful*, on the ſame Account.

XXIV. Now it is evident, that there muſt have been, an *Opacity* of the *Cryſtalin-Lens* in the above Caſes; or, for what Purpoſes would they have paſſed the *Needle?* And if ſo, how could the *Opacity* of the *Vitreous-humour* ſhew itſelf thro' this Body, when *it* refuſed Admittance to the Rays of Light from external Objects? If it were the *Vitreous-humour* only which was affected, as he ſeems to think, it ſhould rather (in order to render it *opaque*) exhibit ſome other Colour, thro' the *Pupilla*, than a tranſparent, or clear Glaſs-colour, which every body knows to be the true Colour of this *Humour*, in a ſound State

of

of the *Eye*; and yet I am ſure, no body will pretend to gueſs at it's Colour, by looking thro' the *Pupilla*: With how much leſs Reaſon, then, ſhould we judge of it's Alteration in a morbid State?

XXV. But, becauſe the learned Author obſerves, that the *Cataractæ ſplendentes*, & *lucentes*, may be always ranked amongſt the *Glaucomata*, or *incurable Cataracts*: I remark, that not only *Paré* and *Antoine*, &c. give Inſtances of the Cure of ſuch *Cataracts*; but alſo, that St. *Yves* (5) expreſly ſays, that "the "Sky-coloured, thoſe of a ſhining "Silver, ſomewhat like clear Glaſs; "and thoſe of the Colour of Sea-"water, ſucceed beſt, next after "the Pearl-colour."

XXVI. As to *Taylor*'s Diſtinction, I only obſerve, that *Petit* the Phyſician

(5) Les maladies de yeux, chap. xviii.

Phyſician denies any Connexion, or Communication, between the *Cryſtalin-Lens* and it's *Covering*; and that in all States of a *Cataract* he has conſtantly found this laſt *tranſparent*. *Memoires de l'Academie des Sciences*, 1730. He alſo affirms, that in every State of a *Cataract*, whether hard or ſoft, of a long Standing or ſhort Duration, he has conſtantly found the *Cryſtalin-Lens* ſmaller, than in it's natural State. (*Sa letre contenant des reflexions, ſur ce qui M. Hequet à dit, touchant les maladies des yeux, p.* 16.) And I dare be bold to affirm, that all who are acquainted with the Writings of that great Man, will take his Word for it.

XXVII. But St. *Yves*'s Opinion, is certainly the moſt ingenous: He defines a *Glaucoma* to be a *Cataract*, complicated with a *Gutta Serena*; and in this Caſe, it is manifeſt, that

depreſſing the *opaque Cryſtalin*, can no way contribute to the reſtoring of Sight; becauſe the *Amauroſis* alone is *perpetual Blindneſs*. But if you mind his Words, you will find, that he had no more Experience for what he advanced, than the Gentlemen his Predeceſſors. He remarks, "that by a careful In-"ſpection into *Eyes* attacked with "this *Diſorder*, he found a ſort of "Alteration in the *Cryſtalin*, which "ſupervened to a *Palſy* of the *Ci-*"*liary Nerves*." Now it is evident, by his own Words, that thoſe Obſervations were made, on People already attacked with a *Cataract*; and in this Caſe, how could he obſerve this previous Weakneſs in the *Muſcle* of the *Iris*? And as to the Dilatation of the *Pupilla*, we all know, that the weaker the Impreſſion, which the Rays of Light give to the *Choroides*, the greater is the

Relaxation

Relaxation of this Part. *See* N. LXVII.

COROLLARIUM I. From what has been ſaid then, it is evident, that the Diſputes about the certain Seat of a *Cataract*, are entirely removed: Diſputes which have too long employed the learned World; ſeeing that if they had but conſidered, the true Situation of the *Cryſtalin-Lens* and *Iris*, a very great deal of Time, Labour, and Paper, might have been ſaved; but yet ſomewhat of greater Conſequence, than all this, particularly advantageous to Practice, may be drawn from the Above.

COROLLAR. II. As then, all *Cataracts* are *Opacities* of the *Cryſtalin-Lens*; that the *Glaucoma* is but a different Name, for the *ſame Diſorder*; and that all *Suffuſions* of the *Cryſtalin-Lens* are remediable, it neceſſarily follows, that all *Cata-*

racts are *equally* ſo. And we do affirm, that all *Opacities* of the *Cryſtalin-Lens*, whether *hard*, *ſoft*, or in whatſoever other State, are *equally curable*, by an *Operation* which we ſhall preſently ſhew; *provided they be not complicated with a* Gutta Serena; which no Author, but St. *Yves* takes Notice of; and indeed, he ſhould firſt have produced ſome Inſtances, to ſupport that Opinion, in order to gain it Credit: But I could produce an Inſtance in this Town, of a Woman who had a *cataractous Eye*, in which the *Iris* had very little perceptible Motion; and which *Taylor* had declared *incurable*; which I nevertheleſs *reſtored* her the Uſe of the Twentieth of *March*, 1749; but that I think, what has been ſaid, is ſufficient to ſatisfy any Man, who ſeeks after the Truth.

COROLLAR.

COROLLAR. III. From the Foregoing alſo, the true State and Conſiſtence of a *Cataract* may be found: Thus, for Inſtance, if it be more elevated in it's *Center*, than in it's *Circumference*, we may affirm the *Cryſtalin* to be hard: If flat, or depreſſed in it's *Nucleus*, we may conclude a *Solution* of *Continuity* in the Parts of it. If it ſeems more prominent, or jetting out in the inferior, than the ſuperior Part of the *Pupilla*, we may ſay, it is a *ſoft*, or *milky Cataract*.

XXVIII. Now in the Caſe of a *Glaucoma*, *Cataract*, or *Opacity* of the *Cryſtalin-Lens*, the Intentions of the Operation, are, the *depreſſing* of this *opaque Body*, by Means of which, the Rays of Light will have a free Ingreſs to the Bottom of the *Eye*, and Sight be reſtored. But as the greateſt Succeſs we can promiſe ourſelves,

ourſelves, from the *Needle*, is, to give the Patient ſome feint Notion of Colours, and Light ſufficient to direct him; and even this is ſo uncertain, that ſometimes it ſhall be but inſtantaneous; ſometimes ſhall continue for a Month or two, or longer; and but very few Inſtances, where it has remained, with even this ſmall Degree of Strength, for any conſiderable Time. From thence, the great Uncertainty of Succeſs, in this *Operation*, even in the moſt promiſing Caſes (the Truth of which the beſt Authors acknowledge) it may be debated, whether it had not been better, to be entirely laid aſide? And indeed it ſeems to be ſo, by the moſt eminent *Surgeons*; who do not care to hazard their Characters, on an *Operation*, from the Succeſs of which only, People judge of the Abilities of the Performer. Tho' indeed it has this to recommend it, (as the learned *Hei-*

ſter

ſter juſtly remarks) that to a Perſon well-inſtructed in the Knowledge of thoſe Parts, there is not the leaſt Danger to be apprehended.

XXIX. This ſmall Degree of Light, which the Patient has, after the Operation is well-performed, has very much puzzled *Phyſicians* and *Mathematicians*, to account for: However, they have done it thus; ——— It is a *Principle* of DIOPTRICKS, That, *Rays of Light, paſſing from a rarer, into a more denſe Medium, are refracted, acceding to the Perpendicular.* Now the Rays of Light, paſſing thro' the Air, from a *luminous Body*, to the *Humours* of the EYE, which are a *denſer Medium*, are here refracted, or broke in their Direction; and this Power of *converging the Rays of Light*, is ſtill greater, in Proportion to the Denſity of the Body thro' which they paſs. However, it is to be

be noticed, that this LAW only regards thoſe Rays, which fall in an oblique Direction; becauſe *parallel* Rays, paſſing thro' different *Mediums*, ſuffer no Refraction; ſeeing there is no Obſtacle in the Body, thro' which they paſs, that ſhould incline them, either to the Right, or the Left; therefore they keep their priſtine Direction.

XXX. Now, this being the Caſe, if the *Eye* was filled with the *Aqueous-humour* only, the Rays of *Light* would be *converged* to a Point conſiderably beyond the *Retina* (6). It was therefore neceſſary, that ſome other Body, of greater Denſity than the former, ſhould be interpoſed, in order to unite thoſe Rays, in a Point nearer the *Retina*: To which Purpoſe, the *Cryſtalin-Lens* wonderfully anſwers;

(6) *Martin*'s Opticks, *Smith*'s Principles of Opticks, and Dr. *Jurin*'s Letter, &c.

anſwers; which, by it's Convex-figure, ſerves to unite the Rays ſooner; and therefore, paſſing thro' the *Vitreous-humour*, which is of leſs Denſity than the former, and of a Concave-ſurface, the Rays muſt be ſtill more *converged*, ſo as to unite upon the *Retina*.

XXXI. If then, by any particular *Idioſyncraſy*, the *Cryſtalin* be rendered *opaque*; when diſplaced by the *Needle*, the *Vitreous-humour* fills up it's Place; and neceſſarily forms a *Convexity* in it's anterior Part, by the lateral Preſſure of the ſuppreſſed *Cryſtalin*. But as this is a rarer *Medium*, than the *Cryſtalin*, of Conſequence, the Rays of *Light* are not ſo ſtrongly *converged*; their *Focus* is therefore beyond the *Retina*, and *Sight ſhould be confuſed*.

XXXII. But, becauſe a great many object, againſt the antient Doc-

trine, That, *if the* Cataract *was a* Membrane *formed in the* Aqueous-humour ; *after depreſſing this* Membrane, *the Patient ſhould ſee, as well as ever* ; ſeeing, that there was no other Obſtacle to their recovering Sight. But it is evident, that they, who make thoſe (as they call them) unanſwerable Objections, are not acquainted with the antient Doctrine : For the *Antients* taught, that as the *Cataract* was formed by the more denſe or ſolid Parts of the *Aqueous-humour*, accumulated ; yet tho' this *Membrane*, or, *accumulated Matter*, were ſuppreſſed, *Sight* was ſtill imperfect ; becauſe the Remainder of the *Aqueous-humour*, had loſt it's more denſe Parts ; the *Refraction*, therefore of the Rays of Light, was not ſo great, and Sight was proportionably weak. This I mention, not that it is any way neceſſary to our Diſcourſe, but barely to ſhew, how juſtly the *Antients* reaſoned ;

reaſoned; and at the ſame time, that the Sentiments of all *Parties*, with reſpect to this *Diſorder*, might be here explained.

XXXIII. But it is to be remarked, that the moſt exact *Opticians*, have found this Difference of *Refraction*, between the *Cryſtalin-Lens* and *Vitreous-humour*, ſo inconceivably ſmall, that it is ſcarce diſcernible (7). Their Difference, as to *Denſity* and *Specifick-gravity*, is but ſmall. If then, the *Refraction* of the Rays of Light, out of *Air* into *Diamond*, (the moſt denſe *Medium*) is, according to the niceſt Obſervations, but as *five* to *two*; how very ſmall then muſt it not be, when paſſing from the *Cryſtalin-Lens* to the *Vitreous-humour*? ſo *ſmall*, that the learned *Heiſter (in Diſſertatione de*

(7) Kepleri Dioptrices, Newton, de la Hire, &c.

Amauroſi) thinks, that *the* Reſolution *of the* Vitreous-humour *into* Water ; (8) and even that of the *Cryſtalin-Lens* too (9) ; are nor alone, by their *Rarity*, ſufficient to cauſe a *Gutta Serena*. But can any thing more *manifeſtly* ſhew, the very ſmall Difference of *Refraction*, between thoſe two Bodies, than the ſimple Experiment of HUGENIUS, *Dioptr. Propoſ.* 31 ? Who, by forming an *artificial Eye*, with the ſame Size of a natural one ; and filling it, with Water only, had the Images, from external Objects painted on it's Bottom. See further Improvements on this Machine, *in* Heiſter de Cataractâ, Fol. 137, *&c.*

XXXIV. But thoſe our Arguments are unanſwerable, if we reflect

(8) L'Anatomie Chirurgicale de Palfin, p. 396.

(9) Rolfoncii Diſſertat. Anatom. lib. I. cap. xiii.

flect on the noted Inſtance of *Surgeon Petit*, the Father; (1) who tells of a Man, in whom the *opacous Cryſtalin* had paſſed into the anterior Chamber of the *Eye*, which Body he extracted, by opening the *Cornea*; and nevertheleſs, this Man could ſee with the ſame Force, that People generally do, after depreſſing the *Cataract*. St. *Yves* (2) relates two or three more ſuch Hiſtories, in his own Practice. Now, if the above *Hypotheſis* (N. XXIX.) were true, this Man ſhould not ſee at all; becauſe, beſides the *Vitreous-humour*'s being a *rarer Medium*, (N. XXX.) the *Cryſtalin-Lens* is alſo taken out, and the *Eye* has not it's full *Convexity*. And in this Caſe, the Rays of Light ſhould unite at a Point, *conſiderably* beyond the *Retina*: The *Falſity* of which,

(1) Memoires de l'Academie Royale des Sciences, 1708.

(2) Les maladies de yeux, chap. xxi.

which, thoſe Inſtances *manifeſtly* prove.

XXXV. But, becauſe the ingenuous Dr. *Porterfield* (3) ſhews the Impoſſibility of a Man's ſeeing well, after depreſſing a *Cataract*, from the Difference of Texture, in the Body of the *Cryſtalin*; it being more ſolid in it's *Center*, than in it's *Circumference*; and of Conſequence, that the Light ſhould *here* ſuffer a greater Degree of *Refraction*. This *Mechaniſm* the *Doctor* thinks was neceſſary; becauſe, otherwiſe, the Rays, paſſing thro' it's *Circumference*, would meet at a Point nearer the *Retina*, than thoſe which paſſed thro' it's *Center*; the Light in this laſt Caſe, running a ſmaller Space. This Objection had been made to me, before I ſaw the *Doctor*'s Second *Eſſay*, by Dr. *Camper*, a very ingenuous

(3) Medical Eſſays of *Edinburgh*, Vol. IV. p. 152, *&c.*

nuous Phyſician of *Leyden*, and who has particularly applied himſelf to the Study of this Organ.

XXXVI. But to this, I anſwer, that if we conſider, *that the* Center *of the* Cryſtalin, *is always* parallel *to that of the* Pupilla; we will find, that the Rays of Light, which fall on this Part, ſuffer no *Refraction*. (N. XXIX.)--- From all which, I think, we may juſtly conclude, Firſt,

That the Reaſon, why we ſhould not ſee better after the Operation, (not to mention, the Uncertainty of it's ſucceeding in moſt Caſes) *has not yet been ſufficiently known*. Secondly,

That the Cryſtalin-Lens *no further contributes to* Sight, *but by it's Tranſparency, and ſerving as a* Medium, *to preſerve the due Convexity of the* Eye.

XXXVII. But

XXXVII. But thoſe *Corrollaries*, will ſtill appear more *manifeſt*, if we conſider, what numberleſs Experiments have ſatisfied me of: *viz. That the* Cryſtalin-Lens, *in moſt Sorts of Animals*, (Men, &c.) *of the ſame* Species *and* Age, *is generally of the ſame* Weight, Convexity *and* Diameter: Thus, for Inſtance, in *Men*, it is about four Grains; in *Youth*, two Grains, ¾, or three Grains: In *Sheep*, about twenty Grains, in *Bullocks*, forty, and ſo on. But the *Vitreous-humour*, never preſerves this Regularity; for, in the *two Eyes* taken out of the *ſame Head*, you will find a *great Difference*, with reſpect to their *Quantities*; *one Eye* containing, ſometimes a *Third* more than the *other*, ſometimes *leſs*; but *rarely*, the *two Vitreous-humours* of the *ſame Animal* are, alike *heavy*.

XXXVIII. *Lemnius* (4), as alſo *Borelli*, have obſerved, that we ſee better with the *left Eye*, than with the *right*; and indeed, in general, this Obſervation is true: But M. *Le Cat* (5) denies it to be conſtantly ſo; becauſe, ſometimes (as he ſays in his own Caſe) the right is the beſt ſighted. This *Phænomenon* ſome have accounted for (6), from the different Partings of the two *Carotid-Arteries*: The left, ariſing immediately from the *Aorta*; whilſt the right Parts, from the right *Subclavian*; and of Conſequence, the left Eye is better and ſooner ſupplied. But this cannot be a ſatisfactory Reaſon, even tho' the left *Eye* were always the beſt ſighted. This Diſproportion then, in the *Vitreous-humour*,

(4) De miraculis occultis naturæ, p. 371.
(5) Traité des ſens.
(6) Les Entretiens phyſiques de Pere Regnault.

mour, evidently points out the Reaſon of this Appearance.

XXXIX. This Diſproportion of the *Vitreous-humour*, very naturally explains, the Cauſe of the *Præſbitæ*, or long-ſighted; and the *Myopes*, or near-ſighted. Thoſe are generally imagined, to proceed from the too great Convexity of the *Cryſtalin-Lens*, in the latter Caſe; by which Means, the Rays of Light, from diſtant Objects, unite, before they arrive at the *Retina*; or, from too great a Flatneſs of this Body, in the *Præſbitæ*, on which Account, the Rays from near Objects, have their *Focus*, beyond the *Retina*. But as thoſe different Figures of the *Cryſtalin*, are only imaginary; and that, the too great, or too ſmall Quantity of the *Vitreous-humour*, in different Eyes of the ſame Species (N. XXXVII.) is *manifeſt*, we think this laſt more evidently

evidently to account for thoſe *Phæ-nomena.*

XL. Having then, I think, evidently proved, the very ſmall Difference of *Refraction*, between the *Cryſtalin-Lens*, and *Vitreous-humour*; too ſmall, to occaſion that very ſmall Quantity of Light, which People enjoy, after precipitating the *Cryſtalin*: I ſhall now ſhew, by the ſame Force of Arguments, and Facts equally *convincing*, the *true Reaſon*, why we do not poſſeſs better Sight, after depreſſing the *Cataract*; as alſo propoſe an Operation, by which a Perſon, in any State of a *Cataract*, SHALL SEE, PRETTY NIGH AS WELL AFTER THE OPERATION, AS IF NO SUCH DISORDER HAD EVER HAPPENED.

XLI. The *Vitreous-humour* is covered, by a very fine *Membrane*, which is compoſed of two *Lamina:*

At the Cavity or Socket of the *Vitreous-humour*, in which the *Cryſtalin-Lens* is lodged, thoſe *Lamina* ſeparate; the internal Covering, the Cavity of the *Vitreous-humour*, and poſterior Convexity of the *Cryſtalin-Lens*; whilſt the external *Lamen*, ſurrounds the anterior Part of this Body; by which Mechaniſm, the *Cryſtalin* is firmly attached to the *Vitreous-humour*. It is remarkable, that the anterior Part of this Membrane, is much thicker than it's poſterior Part; and this M. *Winſlow* ſeems to think (7), proceeds from ſome Expanſions of the *Retina*, over this Membrane. *Morgagni* has obſerved, that the internal Surface of this Membrane, is conſtantly humected with a clear *Lymphatick-Water*; and *Petit* the Phyſician (8) denies any Communication

(7) Expoſition Anatomique, Tom. IV.
(8) Memoires de l'Academie, 1730.

cation between this Membrane, and it's interpoſed Body, either by Blood-Veſſels, or otherwiſe; but that this laſt is nouriſhed, by abſorbing the Lymph ſurrounding it.

XLII. This Lymph is ſupplied by a particular Veſſel, which piercing the *Eye*, with the *Optick-Nerve*, paſſes obliquely thro' the *Vitreous-humour*, and ſurrounds the poſterior Part of the *Cryſtalin-Lens*; giving very fine Ramifications, which creep into this Body, and diſcharge themſelves there. *Petit* the Phyſician, has conſtantly found this Lymph to exiſt, as well in a morbid, as a ſound State of this Organ.---We have often Inſtances of *Cataracts* ſubſiding of themſelves; of this *Mayern* (9), and *ô Mara* (1) give two notable Hiſtories: This happens, when the *Cryſtalin* has acquired a ſolid Conſiſtence;

(9) Prax. Mayern. cap. xiii.
(1) Hiſtoriæ aliquot medicæ rariores, p. 174.

ſiſtence; and by continually preſſing upon the inferior, and lateral Part of the *Capſula*; which is leaſt capable of Reſiſtance, it at length, gives Way, and the *Cryſtalin* ſlips thro' the Opening by this Liquor's lubricating the internal Surface of the *Capſula*.

XLIII. The Structure of this Membrane, being thus deſcribed. The Needle being introduced, and the *Capſula* perforated, the *Cryſtalin*, by a certain *Encheireſis*, is thrown out, and depreſſed, under the *Vitreous-humour*; but it's Membrane, or Covering, ſtill remains, being a Continuation of the *Vitreous-tunick*. Now this *Capſula*, being a Part endued with a great Elaſticity, immediately after retracts itſelf, and covers the now convex *Vitreous-humour*.

XLIII. If

XLIII. If then it happens to be ſtill tranſparent, the Light may paſs thro' it, (ſhrivelled as it is) for ſome time; but as thoſe very fine *Capillaries*, which part from the *Vaſcular* Circle of the *Iris*, to ramefy upon, and nouriſh this Membrane, are, by this Means broke, it is rendered opacous, and of Conſequence, light, very much obſtructed. And it is this Membrane, thus pierced, which *Maitre-Jean* calls by the Name of an *Appendix*, or Excreſſence of a *Cataract*. It was this alſo which occaſioned thoſe ragged Films, which our learned Countryman, the Honourable Mr. *Boyle* (2) obſerved in a Man after couching a *Cataract*. But then it may be demanded, why thoſe Filaments are not oftener obſerved? To which, I anſwer, that it depends, *firſt*, on the Skill of the Operator, in not hacking

(2) Philoſophical Works, Vol. III. p. 595.

hacking this Membrane too much: *Secondly*, on the Quantity of the opaque Body depreſſed. For if it be not much diminiſhed in Bulk, the Eye loſes nothing of it's Convexity; and of Conſequence, this Membrane has not ſufficient Space, to float in the Eye.

XLIV. Now in examining an Eye, upon opening the *Cornea tranſparens*, and preſſing on the Ball of the Eye, the *Tunica-Aranæa* is broke, and the *Cryſtalin* immediately diſengages itſelf and puſhes itſelf thro' the *Aperture* in the *Cornea*. By this Means, it's Membrane lies on the Socket of the *Vitreous-humour*, unregarded by reaſon of it's great Tranſparency; tho' moſt who have diſſected an Eye this Way, have found ſomewhat like Hairs in the *Vitreous Cavity*, which were nothing elſe than the Folds of this Membrane. Perhaps, it might be ſome

ſuch

ſuch Appearance, which occaſioned the learned *Brigs* (3), and ſome other great Men, to deny the Exiſtence of any ſuch Membrane: But it certainly, not only exiſts, but is alſo of much greater Denſity, than is generally imagined; ſeeing M. *Winſlow* (4) has been able, with a common Scalpel, to ſhew it compoſed of two *Lamina*, with a Sort of Cellulare Subſtance interpoſed.

XLV. But if you infuſe an Eye, for thirty or forty Hours, in Spirits of Wine, or any other *Acid-Menſtruum*, and after examine it, as above, you will find a whitiſh Sort of Opacity, in the *Vitreous-Cavity*; which is occaſioned by this Liquor's rendering, the Humours of the Eye more ſolid, and opacous, and their Membranes denſer. Now in exa-

(3) Opthalmographia, p. 16.
(4) Son Expoſition Anatomique.

mining the Eye of M. *Bourdelote*, (Vide N. XVII.) the clouded Body, which was obſerved in the *Vitreous-humour*; and which *Briſſeau*, and after him *Heiſter* concluded to be a *Glaucoma*, was nothing elſe, than the *Tunica-Aranæa* contracted, and no Doubt, a little offuſcated too. To the ſame Cauſe, we aſſign what *Scheuchezer*, Phyſician of *Zurich* in *Swiſſerland*, relates (5) of a Woman, whoſe *Cryſtalin* was depreſſed; and upon examining this Eye after Death, the anterior Part of the *Vitreous-humour* was found thick and clouded.

XLVI. To the ſame it is, that we attribute, what *Morand*, the Son, gives to St. *Yves* (6), in relation to two *Cataracts*, which he depreſſed in a Soldier of the *Invalids*. In each

(5) Acta Medico-phyſica Naturæ Curioſor, Tom. III. Obſ. 36.

(6) Reponſe à une letre critique de M. Mouchard, contre ſon traité des maladies des yeux.

each Eye, he found the *Cryſtalin*, lodged under the *Vitreous-humour*; and this laſt convex in it's anterior Part. This (it's anterior Part) he found, covered with Specks of a whitiſh Colour, in each Eye; and thoſe Specks he imagines might be occaſioned by the Cicatrices of ſome Scratches, which the Needle might have made in the Operation. St. *Yves* thinks, thoſe clouded Specks proceed only from *Cataracts*, which have been depreſſed before full ripe; and ſo are hacked and cut to Pieces, in the Operation: Nor is he at all ſurpriſed, to find in operated Eyes, ſometimes *Membranous-ſhreads*, which he attributes to the ſame Cauſe.

XLVII. It is a little ſurprizing, that three ſuch great Men, as *Winſlow*, *Petit* and *Morand*, who were at the Examination of the above Eyes, would not enquire more par-

ticularly into the Cauſe of them Opacities, which they obſerved in each Eye. Had the great *Winſlow*, but remembered, the beautiful Deſcription he gave of the *Cryſtalin-Membrane*, it's Denſity, Elaſticity, *&c.* or *Petit* but recollected, the great and uſeful Diſcoveries he made, with reſpect to this *Capſula*, and it's contained Body, they would have quickly ſeen, the Cauſes of them opaque Bodies; by which Diſcovery, joined to their great Knowledge, in the Structure and Make of thoſe Parts, we ſhould perhaps ſee, this Operation, in greater Credit, than it now is: Since it is evident, from what has been already ſaid, (N. XXXIII. *ad* XL.) That, if a Method was found out, to take away the *Capſula* with the opaque *Cryſtalin*, WE SHOULD SEE PRETTY NIGH AS WELL, AFTER THE OPERATION, AS IF NO SUCH DISORDER HAD EVER HAPPENED.

XLVIII.

XLVIII. From the Structure of thoſe Parts, ſuch an Operation ſeems feaſible, and not to be attended with any Danger. *Firſt*, by a Diſcharge of Blood, which by diſturbing the Humours, might deſtroy Sight; becauſe the very fine Veſſels, which the *Choroides* gives to the *Tunica-Aranæa*, contain but the ſercus Part of the Blood; ſo that wounding of them is not attended with the leaſt ill Conſequence. Nor is there more to be feared from the Blood-Veſſel, which piercing the Eye, with the *Optick-Nerve*, ſpreads itſelf over the *Retina*; becauſe, beyond the Middle of the *Vitreous-humour*, it's Expanſions are but mere *Limphaticks*.

XLIX. However, I muſt not omit mentioning, that I once ſhewed, the poſterior Part of this Membrane entirely ſpread over, with Blood-Veſſels.

Veſſels. They took their Riſe, by ſome little Branches, from the *Ligamentum Ciliare*; and by others, from the Artery of the *Retina*; and uniting into one Trunk, ramified themſelves differently, all over, the poſterior Part (only) of this Membrane. I took of this Membrane with a great deal of Care, and Circumſpection; and tho' I imagined, the *Cryſtalin-Lens* did not come out, with it's uſual Facility; yet could I not conclude, from thence, that there was any Communication between the *Cryſtalin*, and it's Membrane; becauſe, upon examining the former, even with a good Glaſs, I could not perceive any thing that ſeemed like a Blood-Veſſel, in this Body.

L. The Method I took for this (and which I think is more certain, and occaſions no Diſputes, which it is imagined, Injections often do) was,

was, by hanging a young Dog, by his hind Feet, to a Poſt: In about ten Moments after, I could perceive the Blood-Veſſels of the Eye, become more manifeſt. I then got an Aſſiſtant, to hold his Head firm; and with a convex Needle, took up both the Jugulars. By this Means, the Blood was intercepted, in it's Return to the Heart; and of Conſequence, all the Blood-Veſſels filled up. The exact Figure of this Blood-Veſſel, as it really appeared, I have cauſed to be engraved, in one of the Plates annexed to this Work. See *Plate* II. *fig.* 5.

LI. This Experiment, juſtly explains, a *Phænomenon*, which has been often treated of. People imagine, ſometimes, that they ſee Hairs, or ſome opaque Bodies, ſwimming in the Air, which hide Part of an Object from them. To explain this Appearance, ſome have had Recourſe to

to Spots on the *Cryſtalin*, which refuſe a Paſſage to the Light. But as it certain, that People who complain of this Diſorder, have the *Cryſtalin* clear (for it is impoſſible, that there ſhould be an Opacity in the *Cryſtalin*, without it's appearing ſo, to a Spectator) it is not a ſufficient Reaſon. Others have had Recourſe to too great a Dilatation of the Blood-Veſſels, on ſome Part of the *Retina*. But as the *Retina* is always plentifully ſupplied, without any Inconvenience to Viſion, we reject this Reaſon alſo. The poſterior Part of the *Cryſtalin-Capſula*, in a natural State, receives it's Nouriſhment, by *Limphaticks*: If then it happens, that pure Blood is forced into them, in whatſoever Part it lies, ſo much of an Object, will be certainly hid from us. Nor is this Explication otherwiſe worth mentioning; but becauſe it ſhews us, a Means to remedy this

this Inconvenience; which is, by plentiful Bleeding, in the Jugular-Vein, purging, and a diluting Diet, which leſſen the Quantity, and attenuate the Viſcidity of the Blood; and ſo hinder the ſanguineous Points from coagulating in thoſe very ſlender Tubes.

LII. In the *Nyctalopia*, the Patient is quite blind in the Day-time; but towards Evening, begins to diſtinguiſh Objects; and after Night-fall, ſees pretty well. This *Phænomenon* may be thus explained: In the Day-time, the *Pupilla* is contracted, ſo that the Blood, which is forced into the *Limphatick-Veſſels*, and which principally ſpreads on the Center of the *Capſula*, ſtops a Paſſage to the Light; but in the Night-time, when the *Pupilla* becomes more dilated, the Light paſſes thro' the Sides of the *Cryſtalin*; and is the Reaſon why, ſuch Per-

ſons ſee beſt in the Dark. But to this, I own, there may be an Objection made, which I cannot anſwer; nor would I have any one form a Method of Cure, from ſuch a *Principle*, leſt it might be erroneous. For, as the Contraction and Dilatation of the *Pupilla*, are in Proportion to the *Impetus*, which the Rays of Light impreſs, on the *Choroides-poſterior*, it will conſequently follow, that, when the Rays of Light cauſe no Senſation here, the *Pupilla* ſhould be in a State of Inaction, that is, quite dilated (N. LXVII.) This I mention, to ſhew, how dangerous it is, to adhere to any Theory, how probable an Air of Truth ſoever it carries with it; more eſpecially, when we would endeavour to make our Practice coincide with it.---But to our Subject.

LIII. Nor from the Parts, engaged in the Operation, is there more

to

to be feared. It is true there is ſome Connexion, between the *Iris*, and *Vitreous-Membrane*, by Means of the Indentations of the *Proceſſus-Ciliares*, on this Part. But it is to be obſerved, that thoſe Notches are below the *Cryſtalin*; and even tho' they were not, yet if, what they call adherent *Cataracts*, are ſucceſsfully ſeparated from the *Iris* (ſee *Paré*, *Briſſeau*, *Antoine*, &c.) without any dangerous Conſequences enſuing; ſure then, there is much leſs to be apprehended here.

LIV. But becauſe the ingenuous Dr. *Porterfield*, already mentioned, endeavours to ſhew, that the different Figures which the Eye takes, is occaſioned by the Attaches of the *Ligamentum-Ciliare* to the *Cryſtalin-Lens* (7); and of Conſequence,

(7) See alſo *Keplerus*, in his *Dioptricks*, *Martin*, *Pemberton*, *Graveſend*, and moſt Authors, who have wrote on this Subject.

that People, after couching, have not that Facility of altering the Figure of their Eye, for different Objects. I obſerve, that there is not any Attaches between thoſe two Bodies, more than what has been, already, taken Notice of, (N. XLVIII.) at leaſt, by any Experiment that we can make: For, if you perforate the *Capſula*, and puſh out the *Cryſtalin-Lens*, it's Membrane immediately covers the *Vitreous-humour*; which ſure, it could not do, were it any ways attached to the *Ciliary-Ligament*. Or, if, after ſtripping off the *Sclerotica*, you divide the *Choroides* all round, below the *Ligamentum-Ciliare*, and pierce the *Aranæa*, ſo as entirely to ſeparate this Membrane, from the *Vitreous-tunick*, and then puſh out the *Cryſtalin*, yet ſtill you diſcover no Adherence.

LV. But

LV. But becauſe, to prove a Thing of this Conſequence, a Man can never be too exact in his Experiments: I remark, that ſuch an Adherence is quite impoſſible, from the different Situations of the *Cryſtalin-Lens* and *Ligamentum-Ciliare*. This laſt being, the poſterior Part of the *Proceſſus-Ciliares*; which *Proceſſus* cover, and in ſome Shape adhere to, the anterior Part of the *Vitreous-humour*, without touching the *Cryſtalin-Capſula* at all. If then the *Proceſſus-Ciliares*, which are three or four lines nearer the *Cryſtalin*, than the *Ligamentum-Ciliare* is, have no Adherence to this Body; with how much, then, leſs Appearance of Reaſon, can we ſuppoſe an Adherence, between it, and the *Ligamentum-Ciliare?* And by which alone, we would pretend to explain the different Figures which the Eye takes.

LVI. As

LVI. As then, Authors have not been sufficiently exact in their Description of this Adherence, between the *Sclerotica* and *Choroides*, which is very necessary for every Surgeon to know. I have found, by careful and repeated Dissections, that this Adherence does not rise, from the Border of the *Sclerotica*, round the Eye, at the Origin of the *Cornea-Transparens*; but that, in the Middle, and lateral Parts of the *Uvea*, there is, a full Line, in Distance, between the anterior Border of the *Sclerotica*, and the *Ligamentum-Ciliare*: And that here, the Adherence is a full Line in Breadth; when, on the Contrary, in the superior and inferior middle Parts of the Eye, it is just at the Border of the *Sclerotica*, and not above $\frac{1}{4}$ of a Line in Breadth. I have been the more exact in this Description, as it so essentially

ſentially concerns the Operation. See *Plate* I. *and* II.

LVII. By this Account, it appears, that all the Figures, given of the Eye, have been faulty; even that of *Petit*'s (8) the moſt exact, is ſo. For, by looking over ſuch Figures, we ſhould imagine the *Iris* to be quite ſtraight; and to ariſe immediately from the anterior Edge of the *Sclerotica:* But if we look into a human Eye, we will find that the *Uvea* does not anſwer to the Deſcription, which the Plates give us of it. For it appears, in the Eye, to be of a convex Figure; and juſt adapted to the Parts contained within it; and it's Convexity exactly to anſwer to the jeting-out of the *Cryſtalin.* Had Authors, but juſt conſidered this Circumſtance only,

(8) Sa Letre, dans lequelle il démontre, que le Cryſtalin eſt fort près de l'Uvée, &c.

only, they would quickly have ſeen the Abſurdity of even imagining, a Membrane to be formed here; whether from extravaſated Matter, as St. *Yves* imagines; or from the Union of the more denſe Parts of the *Aqueous-humour*, as the Antients ſuppoſed. This Circumſtance *Aquependente* ſeemed well apprized of, where he declares, that it is impoſſible to paſs the Needle, into the poſterior Chamber of the Eye, without wounding the *Cryſtalin-Lens*; and this, long before it was imagined, that the *Cataract* was an Opacity of the *Cryſtalin*. It is on this Account, that I have cauſed three or four Cuts of the Eye, not, as it is generally repreſented, but as it really appears to be engraved, and joined to this Work.

COROLLARY. Hence it is manifeſt, that we ſhould, not only ſee, as well after the Operation, as we formerly did;

did ; but alſo, that the Eye has the ſame Facility of altering it's Figure, according to the different Diſtances of the Things regarded ; provided the Rays of Light have a free Ingreſs to the Bottom of the Eye.

LVIII. Since then, there is not any Danger to be apprehended from the Structure of the Parts ; and that their Situation alſo favours the Opetion : General Evacuations, ſuch as plentiful Bleedings, Purging and Bathing being premiſed ; as alſo, a ſpare, low Diet, for ſome Days before the Operation, to prevent Inflammation ; having choſe a clear ſerene Day, it may be done thus : The Needle may be made of the ſame Size, with the common Couching-Needle ; with this Difference, that it ſhould be quite flat, and edged, at it's Sides, as well as Point. The Eye ſhould be pierced, about two Lines, and a Half, from the

Cornea-Tranſparens, in the *Conjunctiva*, at the external Angle of the Eye; for if you paſs the Needle, at Half a Line, or a Line's Diſtance, from the *Cornea*, as has been generally directed, you inevitably wound the *Ligamentum-Ciliare*. It is alſo ſafeſt, to paſs the Needle in the Middle of the Globe, and not at all in the inferior Part of the Eye, as is practiſed by ſome; becauſe, by this Means, you chance to wound one of the principal Veſſels, which compoſes the *Vaſcular-Circle* of the Eye; they conſtantly piercing the *Sclerotica*, in two, or three different Places, in the ſame Line, in the ſuperior and inferior middle Part of the Eye. It ſhould enter horizontally, and pierce the *Cryſtalin-Membrane*, towards it's poſterior Part; and continue the Separation of this Membrane, without in the leaſt attempting to preſs on it's contained Body,

Body, which might be apt to ſlip out too ſoon. This Membrane, being thus divided, you are then to depreſs both together under the *Vitreous-humour*. It is to be obſerved, that a *ſpeculum oculi* here, far from expediting, rather hinders the Operation, by preſſing on the Eye, and ſo, not giving ſufficient Space for the Needle to move: 'Tis therefore, on this Account, juſtly condemned by *Heiſter*. But, it may ſometimes happen, that the *Cryſtalin* may ſlip out, before the Diviſion of the Membrane is perfected; and in this Caſe, you pierce the Membrane in it's Center, ſo as to divide it: And this you can the more eaſily do, your Needle being in the Middle of it, and ſo depreſs it, with the opacous *Cryſtalin*, or turn it over, to the contrary Side of the Eye, to which the Needle entered; and by this Means, your Operation will have the

ſame Succeſs, as if you precipitated both *Lens* and *Membrane* together.

LIX. But I am ſenſible, that ſeveral Objections may be made to this Operation: Firſt, from the Attaches of the *Ligamentum-Ciliare*, to this Membrane; but I have evidently ſhewed, the Falſity of this Aſſertion at N. LIV, LV, LVI. It may alſo be objected, that in dividing this Membrane, the *Choroides* may be wounded in more than one or two Places; but as this Needle is edged, at it's Sides, thoſe may continue the Separation of this Membrane, without in the leaſt affecting that Body. But, granting it were wounded (which indeed may be ſometimes the Caſe) need we be more apprehenſive of a Wound of this Part only, than when we find both it, and the *Sclerotica* wounded together, without the leaſt Danger? But then you'll ſay, the *Vitreous-Tunick*

Tunick may be, by this Means, wounded, and of Conſequence, this Humour looſened; and Sight loſt, as St. *Yves* (9) imagines. But it is to be noticed, that this is a pretty denſe Body, which eaſily forms itſelf to the Part, which contains it: Nor will pricking it, in ſeveral Places, make it change it's Situation; which I have often tried, by placing it on my Hand. Nor is there any viſible Membrane to cover this Body; for what ſurrounds it, is but a Sort of a Skin, which is nothing elſe but a Continuation of itſelf, in the ſame Manner, as the White of an Egg forms a Sort of Covering, when expoſed to the Air.

LX. As for that Membrane, which covers the anterior Part of the *Vitreous-humour*, and ſurrounds the *Cryſtalin-Lens*, ſo as firmly to fix this

(9) Les maladies des yeux, chap. xx.

this Membrane in the *Vitreous-ſocket*; I imagine it to be, but, an Expanſion from the *Proceſſus-Ciliares*; becauſe, beyond the poſterior Part of thoſe Notches, you cannot poſſibly ſeparate it. I have often endeavoured to continue the Separation further, by putting it into different *Menſtruum's*, examining it, without any previous Preparations, &c. but never could go any further. However, it would be very adviſable in the Operation, to avoid wounding that Part of this Membrane, which covers the *Vitreous-Cavity*, than which, ſure, nothing is eaſier.

LXI. Having then, I think, manifeſtly ſhewn, That the *Glaucoma* and *Cataract* are but different Names, to expreſs the ſame Diſorder by: That the Reaſon of the Unſucceſsfulneſs of couching was not ſufficiently known; and having ſhewn the true Reaſon of it, with a Method

by

by which this Operation may be always certain, *&c.* I ſhall add, a Method of diſſecting an Eye, by which, with one Eye only, you will ſee all the Parts of this wonderful Organ, *in ſitu naturali*; and which cannot be done by the Methods recommended by ſome (1).

LXII. With the Point of a Biſtowry, or Lancet, you perforate the *Cornea-Tranſparens*; and then, by the Blade of a fine Sciſſors introduced, you entirely cut off this Part: And, as there is ſtill ſufficient Space, between the *Sclerotica*, and *Ligamentum-Ciliare*, you here apply a Forceps, by which Means, the Globe is not preſſed, between the Fingers, nor any of it's Parts broke, or diſplaced. Then, with a fine Scalpel, you gently ſeparate the *Ligamentum-Ciliare*, from it's Attaches to the

(1) Briggii opthalmographia, p. 73. Carteſii Dioptric. cap. v. &c.

the *Cornea-opaca*, quite round the Globe of the Eye. Then, by paſſing one of the Blades of your Sciſſors, between the *Sclerotica* and *Choroides*, you divide this firſt, and ſtill continue with your Scalpel, to ſeparate any little Nerves or Arteries, which, by paſſing from one to the other, might continue the Adherence; and by this Means, you ſeparate entirely the *Sclerotica* from the *Choroides*.

LXIII. By this Means, you will ſee all the Blood-Veſſels, and Nerves, which are diſtributed to the *Iris*: The different Places, where they pierce the *Sclerotica*, glide between it's Interſtices, and enter into the *Choroides*; particularly the two principal Branches, which compoſe *Hovius*'s Arterial-circle, which ſpread themſelves round the *Iris*. Thoſe conſtantly pierce the Eye, in two, or three different Places, in the ſuperior,

perior, and inferior middle Part of the Eye, in Men, as well as Brutes, as numberleſs and indiſputable Experiments have ſatisfied me of. See *Fig.* 1 *and* 2. Then by continuing the Diviſion of the *Choroides*, in the ſame Manner as that of the *Sclerotica*, you will ſee the *Retina*, as alſo, with Care, the *Canal Godronnée* of M. *Petit*, (2) the *Cryſtalin-Lens*, and *Vitreous-humour*, in their true Situation: The *Capſula* of the former; which, not only exiſts, but is alſo conſiderably denſer, and firmer, than is generally imagined. By piercing this *Capſula*, you will ſee *Morgagni*'s *Lymphatick* Liquor iſſue out; and by preſſing a little harder on this Body, the *Cryſtalin* itſelf will ſlip thro' the Aperture. See *Fig.* 4.

(2) Memoires de l'Academie, 1726.

LXIV. The *Iris*, or more properly, the *Choroides anterior*, is always deſcribed to be compoſed of a double Row of muſcular Fibres: Thoſe which immediately ſurround the *Pupilla*, are orbicular; and the radial ones are, on one Side, attached to the orbicular Range of Fibres, and by the other, to the *Ligamentum-Ciliare*. The Uſe given to the Circular-fibres is, to contract the *Pupilla*; and thoſe of the radial ones, to dilate it. The celebrated *Ruyſch (in Theſauro, ejus Anatomica)* tho' he deſcribes the *Iris* after this Manner, yet he freely owns, that the Circular-fibres are not at all diſtinct; and indeed juſtly too:

LXV. For, if you examine this Part with Care, you will find, but one Plan of Fibres, to wit, the Radial; for what gave riſe to the Circular-fibres, was, that the Part of the

the *Iris*, which immediately ſurrounds the *Pupilla*, is thinner than the reſt of this Body, and folded, as it were, in two or three Places, round the Circumference of this *Foramen*. But by carefully obſerving, with a good Glaſs, or even with the naked Eye, you will find thoſe Fibres continue in ſtraight Lines, thro' thoſe Folds, from the Border of the *Pupilla*, to the grand Circumference of the *Iris*.

LXVI. But to put this Point entirely out of Diſpute, it is to be noticed, that no Muſcle (the Heart excepted) can act without a *punctum fixum*. To prove which, nothing can be more evincing than the following Experiment.

The anterior *Maſtoiden-Muſcles*, are, on one Side, attached to the Grove in the *Maſtoid-Proceſſus* of the *Os-Temporale*; and, on the

other Part, to the ſuperior internal Part of the *Clavicula*, and Top of the *Sternum*. Now the Uſe of thoſe Muſcles is, to bend the Head forwards; but this they only do in a horizontal Poſture; becauſe, in an erect Poſture, the Head naturally bends forwards by it's Gravity. But as the *Sternum* is not a fix'd Point, by reaſon of the continual Elevation and Depreſſion of the Ribs, the *Recti-abdominis*, which on one Part, are attached to the *Sternum*, *Cartilago Enſiformis*, and two or three inferior true Ribs; and by the other, to the ſuperior Part of the *Os-pubis*, are alſo in Action, at the ſame time, to raiſe up the Head, in this Poſture. Without the Concurrence of which Muſcles, in order to make a *punctum immobile* of the *Sternum*, we could not, in this Situation, raiſe our Heads. After this Proof, even granting there were ſuch Fibres, yet, I believe, no one will ſay, that they

they could act different from, or independent of each other.

LXVII. The Action of this Part, may then, be thus accounted for. The *Pupilla*, in a State of Reſt, is dilated: This is evident; becauſe, whilſt aſleep, or in any State of Inaction, with reſpect to this Organ, we conſtantly find it ſo. When it contracts itſelf, the Eye becomes more oblong: The *Cryſtalin* and *Vitreous-humour* jet more forward, and ſo, by this Mechaniſm, we lengthen nigh Objects. And the true Reaſon, why we cannot ſee diſtinctly, at a leſs Diſtance than ſix Inches, is, becauſe this Organ cannot form itſelf into an *Eliptical* Figure, ſufficiently oblong, to catch their *Focus*. The *Pupilla* is dilated to view diſtant Objects; by which the Eye becomes more flat, and it's Bottom nigher the *Pupilla*. This is, not ſo much to let a greater Quantity

Quantity of the Rays of Light in at once, as to endeavour to gather the Points of thoſe Rays, which come from the Object we would endeavour to view, to fall on the Bottom of the Eye, in order to be tranſmitted to the *Senſorium commune*.

LXVIII. But, becauſe Diverſities of Opinions are apt to puzzle Readers; and that I have ſeen the Subſtance of a Paper, read before the *Royal Society* (3), wherein the Author endeavours to prove, that the Globe of the Eye, is conſtantly the ſame, on viewing all Objects, at different Diſtances; and that even it was neceſſary that the Eye ſhould not change it's Figure, upon ſuch Occaſions; becauſe, if it did, we could not judge of the Diſtance, or Propinquity of Objects. I own, the Thought to be very ingenuous; and could

(3) *London Magazine*, for *July*, 1749.

could heartily wiſh, that it were as true as curious. But as it is certain, that the Eye does change it's Figure, which, I think, was never before called in Queſtion; and of Conſequence, wanted not many Proofs. I muſt therefore, to ſupport the Side of Juſtice, ſhew that it does. When we bring an Object inſenſibly from the Diſtance of good Sight, nearer the Eye, we obſerve the *Pupilla* imperceptibly to grow ſmaller; and as the Image again recedes from it, to enlarge itſelf. Now neither of thoſe Motions of the *Pupilla* can be done, without an Alteration in the Figure of the Eye; therefore, when the *Pupilla* contracts itſelf, it does it by pulling the *Choroides anterior* forwards; which neceſſarily makes the Eye become more oblong. When the *Pupilla* dilates itſelf, it does it by making the *Iris* more flat, and of Conſequence, receding from the *Cornea*, and preſſing

ſing back the other Humours; by which it is manifeſt, that the Eye muſt become more flat. Nor do thoſe Alterations in the Figure of the Eye, in the leaſt hinder the Diſtinction of the different Diſtances of Objects: Thus, for Inſtance, when I hold an Object at about twelve Inches from my Eye, I ſee it diſtinctly; yet as it gradually recedes from that Diſtance, I ſtill ſee it; but know, that it is at a greater Diſtance, by the Pains which I take to obſerve it, by my Eyes changing it's Figure. And tho' two Houſes, of the ſame Magnitude, with reſpect to each other; and at a conſiderable Diſtance, are ſeen by my Eye diſtinctly; yet I know that one is nigher to me than the other, becauſe it makes a larger Angle on the *Retina*.

LXIX. How thoſe Changes, in the Figure of the Eye are made, has

has been Matter of great Conteſt. It has been generally believed, to be occaſioned by the *Ligamentum-Ciliare*'s advancing, or retracting the *Cryſtalin*; but this cannot be, becauſe the *Cryſtalin* has no Adherence to this Part: Others have imagined it to be done, by Means of the Elongation and Retraction of the *Choroides anterior*; but to this, there have been ſeveral Objections made; the moſt weighty of which is------ If the Motions of the *Choroides anterior*, by Means of it's Attaches to the *Ligamentum-Ciliare*, were the Cauſes of thoſe Changes in the Figure of the Eye, we could not ſee Objects diſtinctly, but at two determined Diſtances; that is to ſay, in the States of Contraction and Relaxation of this Part. But ſure this ſame Objection will hold good againſt thoſe who aſſign the Changes of this Organ, to the different Actions of it's Muſcles. As for me, I believe

thoſe Changes are made by the *Choroides anterior*; becauſe the *Pupilla* is always contracted, at the ſame time, that the Eye becomes longer in it's *Axis*; and when the Eye becomes more flat, the *Pupilla* is dilated. Now, if theſe Changes in the Eye were occaſioned by the Power of it's Muſcles only; and of Conſequence, that the *Choroides anterior* were a Body purely paſſive, it would neceſſarily follow, that when the Eye would become more oblong, the *Pupilla* ſhould be dilated; becauſe, being in itſelf without Motion, it ſhould give Room to the Body preſſing on it: And for the ſame Reaſon, it ſhould contract itſelf, upon the Eye's becoming more flat; becauſe it's Parts, by being flattened, or looſing of their Convexity, ſhould cloſe each other. And as for the Action of a Muſcle, I believe it has different Degrees of Contraction: Thus, for Inſtance, I cauſe a ſtrong

a ſtrong Man to ſtrip the Arm bare, and extend it: Upon his bending the Fore-arm, I perceive the *Biceps* (which, by one of it's *Tendons*, is attached to the *Coracoide Apophyſis* of the *Scapula*; and by the other, to the Grove in the ſuperior Part of the *Humerus*; and uniting, form one ſtrong Tendon, which is fix'd in the Tuberoſity, in the Neck of the *Radius)* to ſwell: Upon cauſing him to lift up a large Book, I perceived it to grow much harder; and upon raiſing up a Chair, I feel it prodigiouſly hard and tenſe. By which it is manifeſt, that the Power of Action in a Muſcle, is in Proportion to the Reſiſtance of the Body; and that the Contraction of the *Pupilla*, is in Proportion to the Propinquity of the Object regarded.

LXX. As then, the *Choroides anterior* is a muſculous Part, which is conſtantly in Motion, we ſee how

neceſſary it was, that it ſhould be well ſupplied with Blood-Veſſels, and Nerves; therefore *Hovius*'s Opinion, that thoſe Blood-Veſſels ſupply the Humours of the Eye, with their Nouriſhment, cannot be true (4). I have very good Reaſons to think that the *Aqueous-humour* is ſupplied by the *Choroides poſterior*; becauſe, after you have diſcharged the *Aqueous-humour* of the Eye, if you take out this Membrane, and put it into Water, it immediately tinges it, as the *Aqueous-humour* would do. If you take it out of this, and put it into freſh Water, it gives it the ſame Appearances; and this it will continue to do, tho' you repeat it ſeveral times: From which we ſhould not be ſurprized at the Facility, which this Humour has, upon being diſcharged to recover itſelf again; nor can I find any Difficulty,

(4) De circulari humorum motu in oculis.

ficulty, in allowing, with *Mery*, this Humour to be ſecerned, by little *glandular* Points, placed in the *Choroides poſterior*.

LXXI. But this Aſſertion will ſtill appear more evident, by an Example which the celebrated *Mery* gives, in the Works of the *Royal Academy*, for 1707, of a Woman, who died at the *Hôtel Dieu* of *Paris*, who had a *Glaucoma*, ſtrongly adhering to the *Iris*, and which ſhut up the *Pupilla*. After he had taken off the *Cornea-tranſparens*, there did not iſſue out the leaſt Drop of the *Aqueous-humour*: But when he had opened the other Coats of the Eye, poſteriorly, this Humour diſcharged itſelf abundantly. *Hovius* has ſomething in relation to a Cataractous-dog, in folio 85 of his Work, which ſeems to confirm this Opinion. This *Mery*, and who has been ſo often before mentioned, in this

this Work, ſeems, by all Accounts, to have been the ſame, who was firſt Surgeon of *L'Hôtel Dieu*; and whoſe Criticiſm upon *Frére Jaques*'s lateral Operation for the Stone (5); and his other Works are held in ſo much Eſteem by the learned World. It is from this Piece, ſome would pretend (6), that the famous Mr. *Cheſeldon* borrowed his *lateral Operation*.

LXXII. At the internal Angle of the Eye, near the *Caruncula-lachrimalis*, is a ſemilunar Fold, deſcribed only by the laborious *Winſlow*; but I have found this Membrane, a Continuation of a Subſtance, partly cartilaginous and bony, which reaches almoſt to the Inſertion of the *Optick-Nerve*. From it's

(5) Obſervations ſur la maniere de tailler, de Frére Jaques.

(6) Parallele des differentes manieres de tirer la piere, &c. fol. 133.

it's Origin, where it forms this ſemilunar Fold, it inſenſibly contracts itſelf, ſo as to form a very narrow Neck, of a firmer Subſtance; from whence it again enlarges itſelf, ſo as to form it's Body, or Belly, which as it augments in Bulk, encreaſes alſo in Firmneſs; and becomes of a bony Subſtance, which terminates a little more poſteriorly than the Inſertion of the *obliquus minor* Muſcle; and exactly between it, and the *Rectus internus* in an oval Form. This Subſtance, which may be called *Os Opthalmicum*, or whatſoever other Name you think more expreſſive, forms internally (with reſpect to the Eye) a Concavity, which exactly anſwers to the Convexity of the Eye; and ſeems wonderfully to facilitate the Motions of this Organ; being in it's concave Part, lined by the *Tunica-conjunctiva*, in which are here ſituated, ſeveral little Glands, viſible enough, thro' which

which an oily ſort of Subſtance ouzes out. It ſeems to me, to receive ſome fleſhy Fibres, from the *Internus rectus* and *Obliquus minor* Muſcles; and generally to anſwer to the Motions of the former. But as I can ſay nothing of Certainty, with reſpect to it's Uſes, I ſhall leave that to others: It is ſufficient for me, thus to have faithfully deſcribed it.

LXXIII. As I have made mention of *Hovius*, in this little Treatiſe: I think it will not be amiſs to give ſome Account of his Work here; more eſpecially, as I ſee ſeveral quote him, who were not thoroughly acquainted with his Writings. He had taken his Degrees at *Utrecht* in 1702; and took for his Doctorial Theſis, *An circularis humorum motus in oculo?* This made a great Noiſe in the learned World, as well for the Newneſs, as the Singularity

gularity of the Discovery: In 1716, he published it with large Amendments and Improvements, such as we now see it. As for the Dispute between *Ruysch* and him, on Account of it, I have nothing to say, seeing, that he has published a long Letter in his own Justification. It is certain, that his Discovery of the Blood-Vessels in the *Eye* was very just; yet I cannot help finding Fault with him, for concealing the Means he made Use of, for this Discovery: However, the Method I have successfully used; and which is much more sure, and admits of less Disputes, than Injections, how fine soever, I have already described at N. L. and by the Help of something analogous to it, I have made more beautiful Injections in other Parts, than the most penetrating and complex Mixtures could do.

LXXIV. The Antients ſuppoſed, the *Cryſtalin-Lens* to be formed by a Sort of Tranſudation from the *Vitreous-humour*: the *Aqueous-humour* the *Fæces* of the two former. *Hovius* thinks, that all the Humours of the Eye, are formed from the Blood-Veſſels, which paſſing over the *Sclerotica*, are differently ramified thro' the Coats of the Eye. It was thoſe Veſſels, which *Nuck* imagined, ſupplied the *Aqueous-humour* of the Eye. (See *Plate* I. *Fig.* 2.) That Part which is ſpread over the *Choroides anterior*, he calls, *ductus oculi aquoſus*. The *Cryſtalin* is a Texture of *Nerves* and *Limphaticks*, *Ad* and *Abductor's*, ariſing from the *Ligamentum-Ciliare*, and croſſing each other in different Manners; and as it is entirely compoſed of *Laminæ*, which ſeparate by Water, *Hovius* thinks, each *Lamin* has an *Ab* and *Adductor* Veſſel; that is to ſay, one

one which conveys it's Nouriſhment to it from the Blood, and that which returns it back again to the Heart. The *Vitreous-humour* receives it's Nouriſhment from the ſame Fountain; with this Difference, that theſe Veſſels paſs off in ſtraight Lines, entering it at one Part, and leaving it at the other Extremity. Thoſe Veſſels riſe chiefly from the *Ligamentum-Ciliare*; and others of them, from the little Ramifications of Blood-Veſſels ſpread over the *Choroides*.

LXXV. As then each of theſe Humours has an *Adductor* Veſſel, or one that brings it's Nouriſhment from the Heart; and an *Abductor*, or one that returns back, this Liquor again, it may be eaſily ſeen, that there is a continual Regeneration, and Circulation of the Humours in the Eye. That is, that in every *Syſtole* of the Heart, the Blood is thrown into

the Veſſels of the Eye, and by them equally expanded thro' all it's Parts; and in every *Diaſtole* ſent back by the Veins. Now, let us ſuppoſe a Dog, the Quantity of whoſe Blood to be a Pound; and granting, that no more than Half a Grain were thrown into the Eye, at every Contraction of the Heart. As the Heart has above two thouſand Pulſations in an Hour, as *Harvey*, *De circulatione Sanguinis*, obſerves; and which *Lowerus* ſays, is the leaſt. Now it is manifeſt, that in an Hour's Time, there cannot be leſs than one thouſand Grains, or two Ounces, two Scruples; which in twelve Hours, is a Pound, nine Ounces; and conſequently, in both Eyes, there is three Pounds, two Ounces, in that Space of Time. But that this Circulation might be more evident, I made an Aperture into the *Corunea*, and after the *Aqueous-hu-*

mour

mour had discharged itself, I applied a Bottle to the Part; and besides, three or four Drops that were lost, there fell into the Bottle, twenty-three Grains, in twelve Moments time. Now, supposing a like Quantity to be secerned, for the *Crystalin-Lens*, in the same time, and four times that Quantity for the *Vitreous-humour*, we shall find, in twelve Moments time, 156 Drops, or two Drams, one Scruple and sixteen Grains of Humours in each Eye. Now for a more evident Proof: If you tie the *Jugular-Vein*, the *Eye* immediately swells, because the Humours, which should be turned back, from the Eye, are here obstructed. But if you tie the *Carotid-Artery*, the Eye immediately becomes flaccid, and dull; because the Humours are hindered a Passage to it. From all which Experiments, it is evident, THAT THERE IS A CONSTANT CIRCULATION OF THE HUMOURS

MOURS IN THE EYE.—— Thus far *Hovius*.

LXXVI. But granting, (as it certainly is) that the Blood-Veſſels of the Eye have this conſtant Circulation, can we from thence infer, that the Humours have the ſame? As the Origin of them is, that Trunk, which ſeparates into two or three Branches, at the poſterior Part of the *Sclerotica*, by what Mechaniſm can it's Expanſions ſeparate Humours ſo different from each other? The minuteſt Canals, or Extremities of Arteries, ſeparate the *Lymph*, yet thoſe are Liquors, quite different from *Lymph*, and yet imagined to ariſe from and go to the Blood. It is certain, that the Blood ſecerns Liquors different from itſelf; as for Inſtance, the *Bladder*, *Urine*, the *Liver*, *Bile*, &c. But then it muſt be alſo granted, that theſe *Secretions* cannot be made, without the Interpoſition of ſome

glandular

glandular Subſtance, ſuch as the *Liver*, *Kidneys*, &c. But, with reſpect to the Eye, there are no ſuch Subſtances, to ſecern theſe Humours from the Blood.

LXXVII. But to come cloſer to the Point: By this Experiment on the Dog, he would prove the Conſtancy of this Circulation, and Facility of the Regeneration of the Humours of the Eye, by ſhewing, that in twelve Moments Time, more Blood is thrown into the Eye, than all theſe Humours, put together, can weigh. But if a determined Quantity of Blood is thrown into the Eye, at every Contraction of the Heart; conſequently the ſame Quantity is returned back, at each Dilation of this Part. If then the *Aqueous-humour* be diſcharged, the Blood cannot be ſuppoſed to give ſo immediate a Repletion to this Part, without leſſening the Quantity to the other

other Parts; ſeeing that in an Hour's Time, the *Aqueous-humour* is again regenerated, as frequent Experiments prove. But the Reaſon why this Humour is ſo immediately formed, and why the *Iris* is ſo well ſtored with Blood-Veſſels, I have already ſhewn at N. LXX.

LXXVIII. But this imaginary Circulation will be found ſtill more weak, by the Remarks of *Petit* the Phyſician (7); who ſhews, that the *Cryſtalin-Lens* has no Communication with the adjacent Parts, either by Blood-Veſſels, or otherwiſe. But to prove that the other Humours, have not this Facility of Regeneration, the Proceſs of couching evidently ſhews; and I find nothing more pertinent to this Subject, than what the late learned Dr. *Molyneaux*, of *Dublin*, relates, in an elegant Latin

(7) Memoires de l'Academie, 1730.

Latin *Memoir*, given into the *Royal Society*, and printed in their Works, for 1730 (8). He tells of a Soldier of *Kilmainhim*, whoſe Eyes being *cataractous*, were both couched: In about nine Years after, the Man died of an *Inflammatory-Fever*. Upon examining his Eyes, there was not found the leaſt Remains of a *Cryſtalin*: From hence, he thinks, (as I do alſo) that after couching, the *Cryſtalin* inſenſibly waſtes away, ſo as in Time, not to leave the leaſt Mark of it behind. If then, Dr. *Hew*'s Opinion were true; it would conſequently follow, that a new *Cryſtalin* ſhould be formed, in about an Hour's time, after depreſſing the former.

LXXIX. But by his Inſtances of the Ligatures of the *Jugular-Vein* and

(8) Philoſophical Tranſactions, N. 384. p. 149.

Carotid-Artery, he ſeems to make it unqueſtionable; but if you will conſider the following Remarks, you will find that thoſe Experiments prove nothing for him: ------ It is certain, that if you tie the Jugular-Vein, the Blood-Veſſels of the Eye will be diſtended, becauſe they cannot return their Contents to the Heart. It is equally true, that in tying up the *Carotid-Artery*, the Eye loſes it's Briſkneſs; yet it is alſo as fact, that in both Experiments the Humours of the Eye, are, neither augmented, nor diminiſhed in their Quantity. From hence then, it is manifeſt, THAT THERE IS NOT ANY CIRCULATION OF THE HUMOURS IN THE EYE.

LXXX. *Lewenhoeck* ſays (9), that the *Cryſtalin-Lens* is compoſed of exceeding fine Threads, or Fibres, croſſing

(9) Philoſophical Tranſactions, N. 293.

croſſing each other differently, and cloſely connected together; without which, it were impoſſible for this Body to keep it's Tranſparency: *Hovius* ſeems to have borrowed his Deſcription of it from him. But this Body itſelf may probably be formed, by this *Lymphatick* Liquor brought to it, by the Canal of the *Cryſtalin-Capſula*; and it's different Degrees of Conſiſtence, according to the different Ages of the Animal; all which the learned *Petit* has elegantly deſcribed (1), ſeems to make it more than barely probable.

LXXXI. The black Subſtance, with which the *Choroides poſterior* is lined; and which I believe, with *Mery*, to be the Origin of the *Aqueous-humour*, M. *Le Cat* (2) very humourouſly accounts for, by

 ſuppoſing

(1) Memoires de l'Academie, 1726.
(2) Traité des Sens, p. 378.

ſuppoſing, that the *Sulphurs* of the Blood, being here, intimately mixt with the *Succus Nervorum*, which he imagines has ſome Analogy to *Quick-ſilver*, forms this Blackneſs; Or, *Mercury*, joined to *Sulphur*, forms a black Powder.

LXXXII. Had M. *Le Cat* examined human Eyes, as well as thoſe of Brutes, he would have found the *Choroides* lined with a darkiſh Brown, inſtead of a black Subſtance. For, whatſoever be the Colour of the *Choroides*, ſo will that of the *Aqueous-humour* be; and therefore, it is black in Sheep and Calves, *&c.* and of a clear Brown in Men and Dogs, *&c.* Howſoever, this we may explain, according to his *Hypotheſis*, by ſuppoſing the Eye to abound more with *Sulphurs* than *Mercury*; and therefore there is not ſufficient of the latter, to blacken the *Choroides*: and this perhaps might be the Reaſon,

ſon, that Sheep's Eyes are more ſprightly than human ones. Such odd Notions it is, that makes ſo many voluminous Authors in Phyſick, and ſo little to the Purpoſe.

LXXXIII. By often conſidering how ſuſceptible the Eye is to violent Inflammation, after precipitating the *Cataract*, and frequent Experiments on that Subject; I think, I have found out the true Reaſon of it, which no one has yet attempted; and which is of too interiſting a Nature to be here omitted. The opaque *Cryſtalin*, after the Operation is generally placed, in the anterior and inferior Part of the Eye, between the *Proceſſus-Ciliares* and *Vitreous-humour*. By this Means, the Artery of the *Iris*, already deſcribed, (N. LXIII) is compreſs'd: In Conſequence of the Compreſſion here, there is too great a Dilatation of

of the Parts elſewhere. The Veſſels on the *Choroides poſterior* (which I believe, with *Mariotte* (3) to be the immediate Organ of Viſion) are filled and diſtended: On this Account, the Rays of Light ſtrike with too great an *Impetus*; Or, the weakeſt Light, at this Time, gives too ſenſible a Vibration to thoſe Parts, already too much ſtretched. From this then the Pain, Inflammation, weeping of the Eye, *&c.* may be reaſonably accounted for. This alſo, juſtly, explains, why the opaque Body, ſometimes riſes again, in conſequence of this Inflammation. From all this, then, it will appear, how neceſſary it is, to make plentiful Evacuations, antecedent to the Operation, as already directed (N. LVIII.) It was for Want of thoſe previous Preparations, that ſo few amongſt the

(3) Ces nouvelles decouvertes, touchant la vuë.

the Number of Poor, which the *German* Oculiſt *Hillmer*, operated on, laſt Winter, in *London*, recovered their Sight. His Method was, any one who offered themſelves to him, he immediately operated on, by ſtriking his Needle into the Eye, as ſome are wont to do, in performing the Operation of the *Paracenteſis*. By this Means, the Needle uſed to enter, ſometimes at the Border of the *Sclerotica*; at other Times, two or three Lines more poſteriorly. But, beſides this indecent Manner of operating, his Needle was very injudiciouſly contrived; being juſt the Make and Size of a large Stocking-needle: By this Means, very often, after the Needle was paſſed into the Eye, the Opacity remained; ſo that I have ſeen him, after turning his Needle backwards and forwards, in the Eye, for above ſix Moments, obliged to draw it out again, and the *Opacity* remain

main behind. His Antagoniſt *Taylor* certainly knew more of the Eye, and was an excellent Operator; but *Hillmer* had two Advantages over him: One, in being a Foreigner; the other, in not ſpeaking *Engliſh*. The only Application he made Uſe of, after the Operation, was, to moiſten a Compreſs in a Mixture of the *Whites* of *Eggs* and *Sugar* of *Lead*, and ſo apply it to the operated Eye, and let Nature do the reſt.

LXXXIV. *Taylor* always made Preparations, by *Phlebotomy*, *purging*, &c. previous to the Operation. The Needle he uſed was *Plano-Convex*. It's convex Part was marked by a black Line in the Handle. But if *Hillmer* made little Ceremony in performing the Operation, this was as much on the other Extreme; inſomuch that he would be Half an Hour tying and untying his

his Garters, turning and winding his Ruffles, and accommodating himself for this grand Affair. But, because he pretended to have mighty Advantages by his Method of operating, I shall relate it at full Length, such as I have heard him describe, and seen him perform, above thirty Times.

LXXXV. General Evacuations being used, and the Day fixt for the Operation; after the Patient had been seated, and exposed to a proper Light, and the Doctor had also fixt himself: The Eye-lids being separated from each other, he fixt his *Speculum Oculi*, by which Means, the Eye was kept firm, and exposed for the Operation. He then, taking his Needle, with it's flat Part, next the Eye, and it's convex Part externally, pierces the Eye with it, exactly in this Position. The Needle

enters the *Eye*, in it's inferior and lateral Part, towards the external Angle: He then gently elevates the Handle of the Inſtrument, inlarges the Aperture of the *Cryſtalin-Capſula*, in it's inferior Part, and thus precipitates the opaque Body. The Operation being over, the Eye is immediately cloſed, by a Compreſs dipt in Spirits of Wine, and ℞, the Patient bled in the *Jugular*, and ordered a Purge for the next Day.

LXXXVI. The great Advantages, which the *Doctor* promiſed himſelf by this Operation, were; *firſt*, by this Means, he pretended to avoid wounding the *Ciliary-Nerves*; and of Conſequence, very little of Pain or Inflammation were to be apprehended from the Operation: *Secondly*, were the *Cryſtalin* in a ſolid, or fluid State, it always occupied

pied the anterior and inferior Part of the Eye, ſo that there was never any Fear of it's mixing with the other Humours, and of Conſequence, of offuſcating them. As for the Operation deſcribed on his Book (4) tho' he ſpends Time and Paper enough in ſhewing it, yet it is ſo confuſed, and at the ſame time, ſhews ſo little Knowledge of the real Situation of the *Cryſtalin*, and it's Attaches, that I have not thought fit once to mention it.

LXXXVII. But the Danger that is to be apprehended from this Operation, is more than an Equivalent for it's Advantages. *Firſt*, from the Danger of wounding the inferior *Artery* of the *Eye*, from which Accident, the entire Loſs of Sight

(4) Le mechaniſme du globe de l'œil, p. 141, *ad* 167.

is very much to be feared. And as to the *Ciliary-Nerves*, they enter into the *Ligamentum-Ciliare* at all Sides; so that it is impossible to avoid wounding them, whatsoever Way you operate. It is true, you very readily discharge the impacted Body by this Operation; but it is also as certain, that you will as readily and effectually do it in the Way I have described, even tho' you have not a Mind to take away the *Capsula*. And as for the *Speculum Oculi*, I have already observed the Disadvantages of it, at N. LVIII. As for *Hillmer*'s Method, it is certainly very bad. For the Needle, which is small, piercing the *Capsula*, depresses the *Crystalin*, rather by dilacerating the Membrane, than any thing else. By this Means, also, the *Crystalin* is broke, and Part of it pushed into the *Aqueous-Chamber* of the Eye. In a Word, then, it

shews

ſhews ſo little of the real Knowledge of the Structure of this Part, and of the Body itſelf, which ſhould be taken away: Not to mention, that two Eyes are never wounded in the ſame Place; becauſe, inſtead of gently piercing the Coats of the Eye, he immediately ſtrikes his Needle into them, that it needs no Words to condemn it entirely.

LXXXVIII. The Needle uſed by St. *Yves* (5) is flat and edged; and with it he pierces the *Sclerotica*, at a Half, or at moſt, a Line's Diſtance, from the *Cornea-Tranſparens*: But by this Means, not only the *Ligamentum-Ciliare* is wounded; but alſo the *Proceſſus-Ciliares*, which he would endeavour to avoid, are certainly touched, by the Directions which

(5) Les maladies des yeux, chap. xx.

which he gives. *Heister*'s Needle (6) is *Plano-Convex*, and with it, he pierces the Eye, at about two Lines distance from the *Cornea*: The same Method is used by *Brisseau*. *Petit* the Physician (7) perforates the Eye, at about two Lines and a Half from the *Cornea*, as I have directed. But he also owns, that the *Crystalin-Capsula* has an Adherence to the *Ligamentum-Ciliare*: And this Assertion the more surprized me, seeing that he took upon him particularly to describe the true Situation of the *Crystalin-Lens*, and this Body, in answer to some Remarks on the *Cataract*, given by M. *Hecquet*, in his *Traité des Amares* (8). Professor *Ferren*'s

(6) Tract. de Cataractâ, p. 298. Tract. ejus Chirurg.

(7) Memoires de l'Academie, 1726.

(8) Sa letre, ou il demontre, que la Crystalin, &c.

Letre des reflexions, &c.

Ferren's Directions for this Operation are pretty nigh the ſame with *Petit*'s.

LXXXIX. I think I cannot conclude this Work, without making ſome Remarks on the Operation of an imperforated *Iris*, or *Artificial Pupilla*, as deſcribed in the Works of the *Royal Society* (9); and from thence, by Mr. *Sharp*, in his Surgery, ſeeing that the Subject I have treated on, requires I ſhould take Notice of it. I think then, that the Operation is very poſſible to be done, but that any Benefit ſhould accrue from it, I think to be abſolutely *impoſſible*; and that for the following Reaſons. *Firſt*, it is impoſſible, to paſs the *Iris* Needle, between the *Cryſtalin-Lens*, and *Uvea*, without wounding the former:

(9) Philoſophical Tranſactions, for 1730.

mer: If then there is little or no Space between them in the natural State of the Eye, there must be still less, when this Part is compress'd by a *Speculum oculi*, which by the Author is deemed absolutely necessary in this Operation. *Secondly*, if the *Crystalin-Lens* be wounded, an Opacity will be necessarily formed in Consequence of the *Solution* of *Continuity* in this Body. Of this I saw a remarkable Instance in a Shoemaker's Boy in *London*, this last Winter, who had wounded the *Crystalin*, by an Awl's piercing the *Cornea*; and which Opacity Dr. *Taylor* removed in *Exeter-Change* in about ten Days after.

XC. But lest I should seem to prejudice the World against this Method, or lessen the Weight of the celebrated Author's Account of *Vision*, &c. in that *Memoir*, Truth obliges

obliges me to declare, that the Patient might ſee immediately after the Operation, and ſo far his Accounts were certainly true; becauſe, tho' the *Cryſtalin* were wounded, yet the Parts would keep their Tranſparency for ſome time, by Means of this *Lymph*, which ſurrounds the *Cryſtalin*; as for Inſtance, an Hour or two; yet ſtill, that the Patient ſhould reap any further Advantages by it, is, what I abſolutely deny. Howſoever, his imagining ſuch an Operation, which the ſuppoſed Situation of thoſe Parts, ſeemed to countenance, (there being always ſuppoſed to be a conſiderable Space, between the *Choroides anterior* and *Cryſtalin-Lens*, which was filled up with the *Aqueous-humour*) deſerves Applauſe.

XCI. If then, at any time, this Operation, (which may properly

enough be called *Koreotomy* (1), ſeeing that we are ſo fond of *Greek* Terms) may ſucceed, it ſeems to bid faireſt for it, when done thus. The Patient being prepared by *Veneſection*, &c. he ſhould ſeat himſelf before a good Light, in the ſame Manner, as if for couching. Then the Surgeon ſhould apply the *Speculum Oculi*, to fix the Eye firm; and with a *Cataract*, or *Iris* Needle, perforate the *Cornea-Tranſparens*, in it's inferior Part. The Needle ſhould enter obliquely; and when you perceive it has entered thro' this Coat, you ſhould leſſen the Preſſure of the *Speculum*, without entirely removing it; and then gently perforate the *Iris* in it's Center, and then draw out your Needle, and remove the *Speculum Oculi*. The Eye ſhould be cloſed, and every other Circumſtance

(1) *A* Κόρη *Pupilla, et* τέμνω *ſecare.*

ſtance obſerved, as if for depreſſing a *Cataract:* And by this Method only, you may perform ſuch an Operation, without wounding the *Cryſtalin-Lens.*

An

FIGURE

PLATE: I

FIG: I

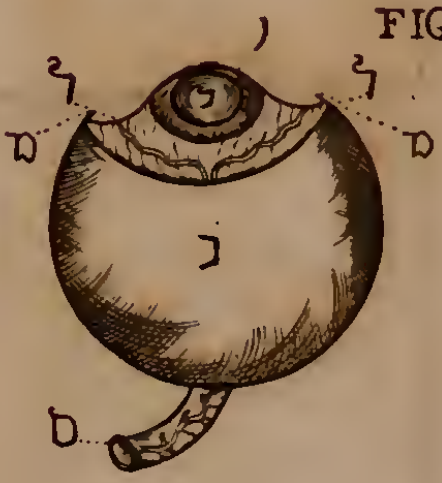
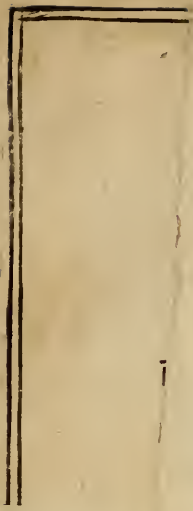


FIG: 2



An EXPLANATION *of* PLATE *the* I. FIG. 1. *and* 2.

FIGURE *the* 1ſt.

א. The *Cornea-Tranſparens.*

ב. That Space between the *Cornea* and *Choroides anterior*, commonly called the *anterior Chamber* of the *Aqueous-humour.*

ג. ג. The *Uvea*, *Iris*, or *Choroides anterior.*

ד. The *Cryſtalin-Lens*, as it appears, on taking off the *Cornea.*

ה. The *Ligamentum-Ciliare.*

ו. The *Sclerotica*, being the firſt of the three Membranes, in which the Humours of the Eye are contained.

ז. The principal Trunk, from which the Eye receives it's Blood-Veſſels; taken from *Hovius.*

ח. The *Optick-Nerve.*

ט. An *Artery*, which, twining round the *Optick-Nerve*, pierces it, and ſo ramifies itſelf on the *Retina* and *Vitreous-humour.*

FIGURE

FIGURE *the* 2d.

1. The *Choroides anterior*.
2. The *Cryſtalin-Lens*.
3. The *Arterial Circle* of the *Choroides anterior*: The ſingle Strokes, aſcending and deſcending from it, ſhew the Ramifications of leſſer Veſſels proceeding from it.
4. The *anterior Border* of the *Sclerotica*, where the *Cornea-Tranſparens* begins, riſing more anteriorly than the *Choroides anterior*: The Space between it, and the *Iris*, ſhews the Diſtance there is between the Beginning of the *Sclerotica*, and *Ligamentum-Ciliare*.
5. The *Sclerotica*.
6. The *Optick-Nerve*.

An

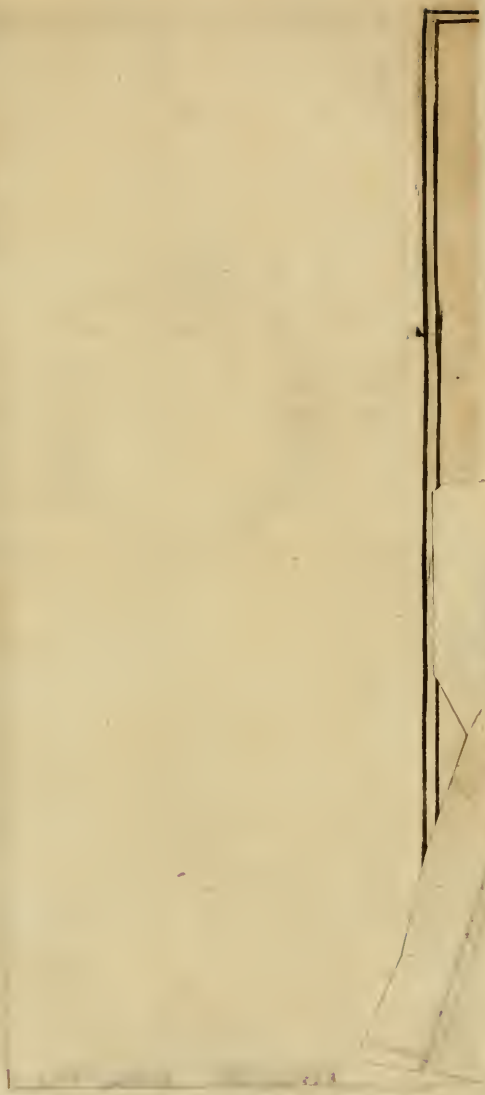


FIGURE *the* 2d.

1. The *Choroides anterior*.

2. The *Cryſtalin-Lens*.

3. The *Arterial Circle* of the *Choroides anterior*: The ſingle Strokes, aſcending and deſcending from it, ſhew the Ramifications of leſſer Veſſels proceeding from it.

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5. The *Sclerotica*.

6. The *Optick-Nerve*.

An

PLATE 2

FIG: 3

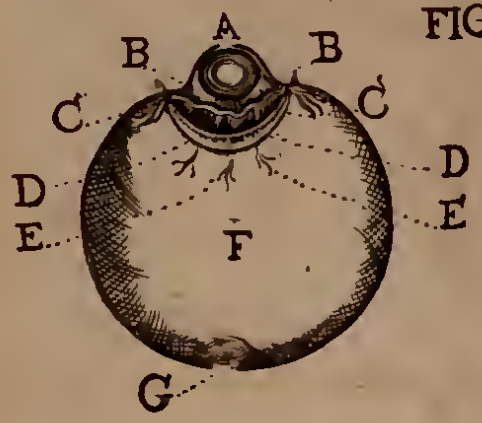
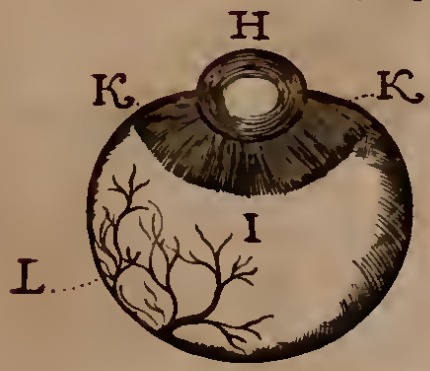


FIG: 5

FIG: IV



An EXPLANATION *of* PLATE *the* II. FIG. 3, 4, *and* 5.

FIGURE *the* 3d.

A. The *Pupilla.*

B. B. The *Iris*, or *Choroides anterior.*

C. C. The *Vaſcular-circle* of the *Iris:* The three Threads, which enter into the *Ligamentum-Ciliare*, and form this Circle, are the *Ductus Aquoſi* of *Nuck*, and which paſs from the *Sclerotica* to the *Choroides*, exactly as marked here.

D. D. The *Ligamentum-Ciliare*, truly delineated.

E. E. are little *Blood-Veſſels*, and *Nerves*, which are diſperſed round the *Ligamentum-Ciliare*, and ariſing chiefly from the *Sclerotica.*

F. The *Choroides poſterior.*

G. Part of the *Retina.*

FIGURE

FIGURE *the* 5th.

*. The juſt Figure of the different Ramifications of a *Blood-Veſſel*, which ſpread itſelf over the poſterior Part of the *Cryſtalin-Capſula*. ------ See N. XLIX.

FIGURE *the* 4th.

H. The *Cryſtalin-Lens*, contained in it's *Capſula*, and lodged in the Cavity of the *Vitreous-humour*, to which it is fix'd by the Continuation of it's *Membrane*, having it's Riſe from the *Ligamentum-Ciliare*.

I. The *Vitreous-humour*.

K. The *Coronæ-Ciliares*, or Indentations of the *Proceſſus-Ciliares*.

L. The Diſtribution of a *Blood-Veſſel*, on the *Vitreous-humour*.

FINIS.